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FINAL PRELIMINARY ASSESSMENT/SITE INSPECTION REPORT SITE UXO-02 UNNAMED
EXPLOSIVES RANGE (ASR 2.201) MCB CAMP LEJEUNE NC
3/1/2012
CH2M HILL

Final

**Preliminary Assessment/Site Inspection Report
MMRP Site UXO-02, Unnamed Explosive
Contaminated Range, ASR #2.201**

**Marine Corps Base Camp Lejeune
Jacksonville, North Carolina**



Prepared for

**Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic**

**Contract No.
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March 2012

Prepared by

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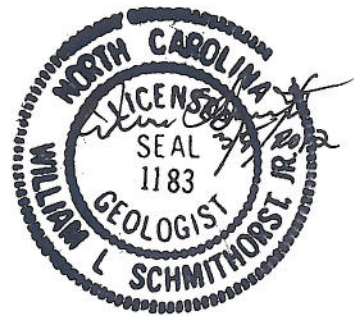
Under the

**NAVFAC CLEAN 1000 Program
Contract N62470-08-D-1000**

Prepared by



CH2MHILL



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Acronyms and Abbreviations

ASR	Archive Search Report
bgs	below ground surface
CA	chemical agent
CAIS	chemical agent identification sets
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-term Environmental Action—Navy
COPC	constituent of potential concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSM	conceptual site model
CTO	Contract Task Order
CWM	chemical warfare materiel
°F	degrees Fahrenheit
DDESB	Department of Defense Explosives Safety Board
DGM	digital geophysical mapping
DO	dissolved oxygen
DPT	direct push technology
DQO	data quality objective
E&E	Ecology and Environment
EcoSSL	ecological soil screening level
EM	electromagnetic
EM61	EM61-MK2
EOD	Explosive Ordnance Disposal
EPC	exposure point concentration
ERS	ecological risk screen
ESS	Explosives Safety Submission
ESV	ecological screening value
FID	flame-ionization detector
ft	feet, foot
ft/ft	foot per foot
ft msl	feet above mean sea level
GIS	geographic information system
GPO	geophysical prove-out
GPS	global positioning system
GSV	geophysical system verification
HE	high explosive
HI	hazard index
HQ	hazard quotient

IDW	investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic
IR	Installation Restoration
IRIS	Integrated Risk Information System
µg/dL	micrograms per deciliter
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
m	meter
MARCORSYSCOM	Marine Corps Systems Command
mm	millimeter
MC	munitions constituents
MCB CamLej	Marine Corps Base Camp Lejeune
MCL	maximum contaminant level
MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MR	munitions response
MRP	Munitions Response Program
MRSP	Munitions Response Site Prioritization Protocol
MS/MSD	matrix spike/matrix spike duplicate
mV	millivolt
NAD83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
NAVFAC	Naval Facilities Engineering Command
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources
NC 2L Standards	North Carolina Groundwater Quality Standards
NC SSL	North Carolina soil screening level
NRWQC	National Recommended Water Quality Criteria
NTU	Nephelometric turbidity unit
ORP	oxidation-reduction potential
OU	operable unit
PA/SI	Preliminary Assessment/Site Inspection
PCBs	polychlorinated biphenyls
PETN	pentaerythritol tetranitrate
PID	photoionization detector
PPE	personal protective equipment
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RSL	Regional Screening Level
SVOC	Semi-volatile organic compound

TAL	Target Analyte List
TOC	top of casing
TLZ	tactical landing zone
TP	technical paper
UCL	upper confidence limit
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
UXO	unexploded ordnance
VOC	volatile organic compound

Introduction

This report documents the findings of a Preliminary Assessment/Site Inspection (PA/SI) conducted at Military Munitions Response Program (MMRP) Site UXO-02 – Unnamed Explosive Contaminated Range (Archive Search Report [ASR] Area #2.201), located at Marine Corps Base Camp Lejeune (MCB CamLej) in Jacksonville, North Carolina (**Figure 1-1**). The site is a 127-acre area that encompasses a 14-acre tract of land known as Operable Unit (OU) 14, Installation Restoration (IR) Site 69 (IR Site 69) - Rifle Range Chemical Dump.

1.1 Objectives and Approach

This PA/SI was conducted by CH2M HILL under the Naval Facilities Engineering Command (NAVFAC) Navy Comprehensive Long-term Environmental Action—Navy (CLEAN) Contract N62470-08-D-1000, Contract Task Order (CTO) 0014. Objectives and Approach

MCB CamLej is in the process of investigating closed ranges at the Base following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation process. Reported historical range activities at Site UXO-02 have prompted this PA/SI, the first phase of the CERCLA cleanup process.

The primary objective of this environmental investigation was to evaluate the potential presence and nature of impacts to environmental media resulting from historical munitions use at the subject site, and to evaluate whether additional investigation and/or remediation activities are necessary. Accordingly, this investigation focused on environmental impacts related to munitions constituents (MC). A secondary objective was to assess the site for the presence of geophysical anomalies that represent potential subsurface munitions and explosives of concern (MEC).

This PA/SI was conducted in accordance with the *Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan) Preliminary Assessment/Site Inspection, Sites UXO-02, UXO-07, UXO-10, UXO-11, and UXO-14, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina (Sampling and Analysis Plan)* (CH2M HILL, 2009a); *Draft Site Specific Work Plan Addendum for Preliminary Assessment/Site Inspection Site UXO-02, Unnamed Explosives Range, ASR #2.201, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina (PA/SI Work Plan Addendum)* (CH2M HILL, 2009b); and the *Munitions Response Program Master Project Plans, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina* (CH2M HILL, 2008a) (Munitions Response Program [MRP] Master Project Plans).

The general approach adopted for this PA/SI was as follows:

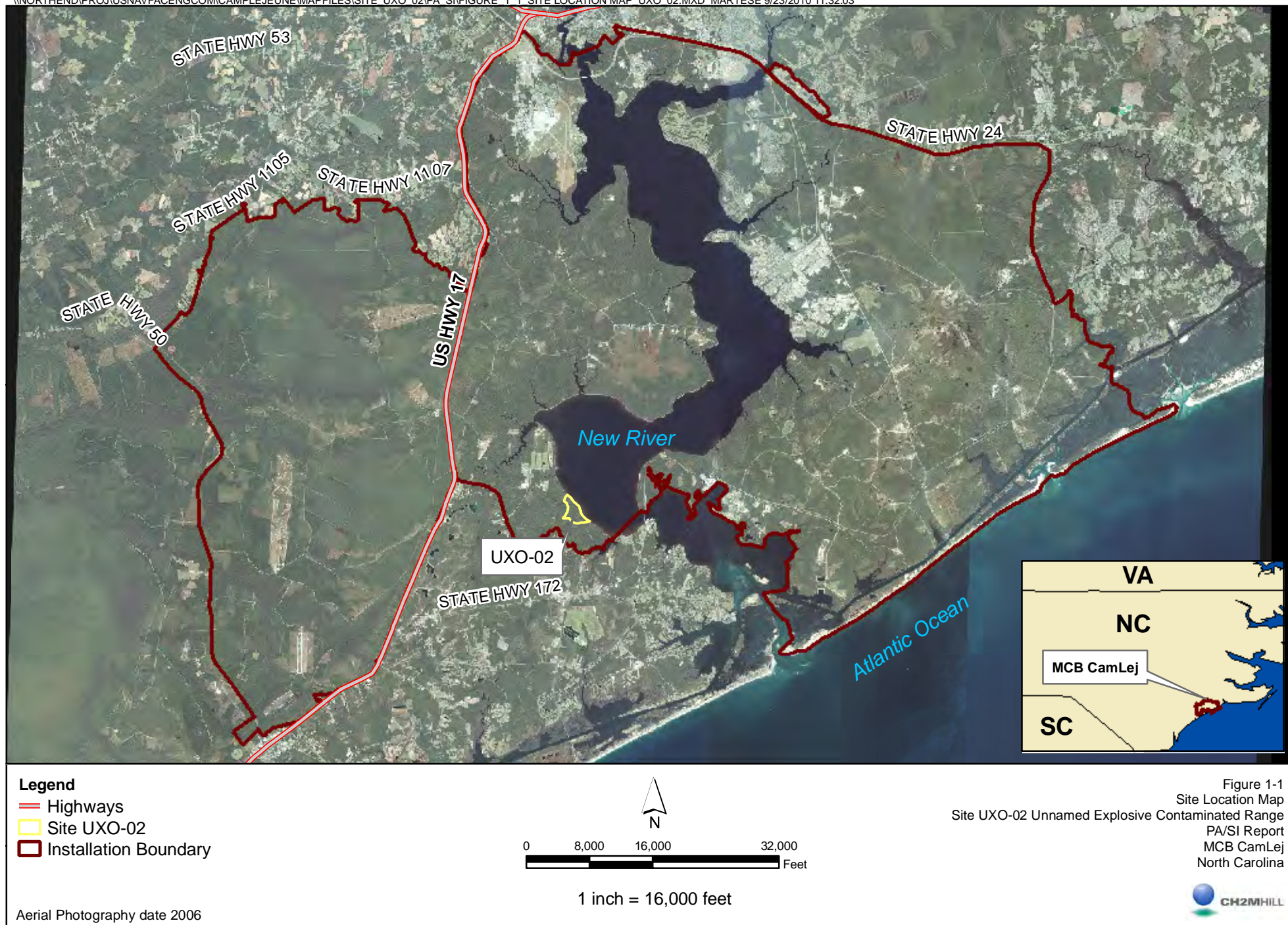
- Conduct research to identify historical activities that may have resulted in MEC or MC contamination at the site, including review of archival records and interviews with current and former installation personnel.

- Perform a geophysical survey of approximately 10 percent of Site UXO-02, excluding the fenced area delineating IR Site 69, to evaluate the number and density of geophysical anomalies representing potential subsurface MEC.
- Evaluate the potential presence and nature of MC contamination by conducting an investigation of soil, groundwater, surface water, and sediment.
- Conduct ecological and human health risk screening using analytical data collected at the site.

1.2 Report Organization

This PA/SI report is organized as follows:

- Section 1, Introduction
- Section 2, Site Background
- Section 3, Field Investigation Activities
- Section 4, Investigation Results
- Section 5, Human Health Risk Screening
- Section 6, Ecological Risk Screening
- Section 7, Site UXO-02 Conceptual Site Model
- Section 8, Conclusions and Recommendations
- Section 9, References
- Appendix A, MRSPP Site Summary Submittal to QA Panel
- Appendix B, Archival Records Search Report
- Appendix C, Geophysical Investigation Report
- Appendix D, Soil Boring Logs and Well Completion Diagrams
- Appendix E, Groundwater Sampling Data Sheets
- Appendix F, Raw Analytical Data
- Appendix G, Human Health Risk Screening Tables
- Appendix H, Ecological Risk Screening Tables



Site Background

This section presents a brief summary of regional and site-specific information, including location, site setting, physical characteristics, and history.

2.1 MCB CamLej Location and Description

MCB CamLej covers approximately 236 square miles in Onslow County, North Carolina and is bisected by the New River, which flows in a southeasterly direction toward the Atlantic Ocean (**Figure 1-1**). Construction of MCB CamLej began in 1941 with the objective of developing the “World’s Most Complete Amphibious Training Base.” The mission of MCB CamLej is to maintain combat-ready units for expeditionary deployment. MCB CamLej provides housing, training facilities, logistical support, and administrative supplies for Fleet Marine Force units and other assigned units. The Base is home to an active duty, dependent, retiree, and civilian population of approximately 180,000. Land use surrounding MCB CamLej is varied, with mainly commercial properties along the northern boundary. The eastern and western boundaries of the Base are a mix of agricultural and residential land. The southern boundary of MCB CamLej extends to the New River and Atlantic Ocean.

2.2 Site Setting

Site UXO-02 is a 124-acre area located within a south-central portion of the Base known as Stone Bay (United States Army Corps of Engineers [USACE], 2001). It is accessed by entering the Tactical Landing Zone (TLZ) Owl Gate at Everett Creek Road located on NC Highway 210 immediately south of the Stone Bay Entrance and following the gravel access road (**Figure 2-1**). The site topography ranges from low-lying gently undulating terrain to the north, deeply incised gullies in the south, and steep bluffs bordering the New River. The local topographic high, approximately 36 feet above mean sea level, lies within the hummocky terrain of IR Site 69. The vast majority of Site UXO-02 is wooded with some areas supporting dense undergrowth and other areas with a high percent canopy closure and sparse understory. Much of the low-lying area is covered by wetlands that discharge into the New River. The only cultural features within Site UXO-02 are the fenced perimeter of IR Site 69, a decommissioned power line extending from the fenced perimeter northward, paralleling the New River, and a poorly maintained access trail (suitable for high-clearance vehicles) from Everett Creek Road.

2.3 Site History

In August 2008, CH2M HILL conducted a detailed review of existing information related to historical activities at Site UXO-02 that could have resulted in the release of hazardous substances within the area of investigation. This review also included interviews with current and former site personnel. The information obtained from this effort is documented in the Archival Records Search Report (**Appendix B**) and summarized below.

The Final Range Identification and Preliminary Range Assessment states that the range "...appears on a range map circa 1973 and no information has been found to describe its use." Site UXO-02 appears as an "...unknown UXO contaminated area..." in subsequent range overlay maps starting in 1987 (Figure 2-2 of Appendix B) (USACE, 2001). Plate 4 of the 1946 Range overlay map indicates that Mortar Range "L-2" was established from 1945-46 in a Camp Training Order (Figure 2-2 of Appendix B) along the southern boundary of Site UXO-02. However, in further conversation with a former Base Range Officer, it was stated that the mortar range was never used as such and the site was used for platoon-level maneuvers from the 1960's to present (Redmond, 2011).

From 1950 to 1976, Site 69 was reportedly used to dispose of chemical wastes including PCBs, solvents, and pesticides. Based on available documentation, Site 69 may also have a history of chemical agent (CA) disposal. Discarded M9 CA detector kits were observed during a 1982 site visit (Water and Air Research, 1983). Formal documentation of disposal methods, particularly related to CA, is unavailable. However, a letter dated October 6, 1982 (Scudder, 1982) refers to an interview with a former heavy equipment operator indicating that drums of possibly nerve or mustard agent were buried in trenches at Site 69. The disposal incident occurred in 1953 or 1954 when approximately 50 to 60 drums of suspected chemical agent were reportedly delivered to the Site and disposed of in two trenches, each approximately 20 feet deep.

A second disposal incident occurred in 1970 when 5-gallon cans and 55-gallon drums of dichlorodiphenyltrichloroethane (DDT), trichloroethene (TCE), and calcium hypochlorite were placed together in a common pit. When soil was being placed over the containers, an explosion occurred, resulting in a brush fire and ejection of drums as far as 120 feet from the pit (Water and Air Research, 1983).

2.4 Previous Investigations

Historical information and previous investigations have been focused on IR Site 69; no known investigations have been conducted in other areas of Site UXO-02. Results from environmental investigations conducted at IR Site 69 are presented in *Draft Supplemental Investigation, Site 69, Operable Unit No. 14 – Rifle Range Chemical Dump. Marine Corps Base Camp Lejeune, Jacksonville, North Carolina* (CH2M HILL, 2010). Environmental investigations conducted at IR Site 69 are summarized below.

In 1981 and 1982, representative samples were collected by the Navy from water supply wells, existing monitoring wells, and surface water in the Stone Bay area including locations in the vicinity of Site UXO-02 / IR Site 69. Analytical results indicated chlorinated volatile organic compounds (VOCs) and trihalomethanes were present in groundwater (Navy, 1981, 1982).

In the 1983 Initial Assessment Study (IAS) conducted by Water and Air Research, Inc. (WAR), the Rifle Range Chemical Dump (Site 69) was identified as a priority site for further investigation based on historical disposal activities (WAR, 1983).

Environmental Science & Engineering (ESE) then completed a Confirmation Study between 1984 and 1991. Surficial groundwater, surface water, sediment, and shellfish samples were collected. Analytical results indicated that VOCs including trichloroethene (TCE), trans-1,2-

dichloroethene (DCE), and vinyl chloride (VC) were present in groundwater in the southern portion of IR Site 69 and in the surface water (ESE, 1992).

Between 1992 and 1996 a Remedial Investigation (RI) was conducted by Baker Environmental, Inc (Baker). This included a geophysical investigation which confirmed the location of suspected disposal trenches in the south and east portions of IR Site 69. Environmental samples were collected in surface soil, subsurface soil, surface water, sediment and groundwater within the Surficial, upper Castle Hayne, middle Castle Hayne, and lower Castle Hayne aquifers (see **Sections 2-6** and **2-7** for details on regional and site hydrogeology). Analytical results indicated VOCs were present above North Carolina Administrative Code (NCAC) 02L.0202 (NC 2L) standards in the Surficial, upper, and middle Castle Hayne aquifers in the southern portion of IR Site 69 (Baker, 1997).

Following completion of the RI, a treatability Study by Baker and SBP Technologies was conducted in 1996 and 1997 and included the installation of ultraviolet B (UVB) and coaxial groundwater ventilation (KGB) treatment systems to evaluate the technologies as potential remedial alternatives. The UVB system was successful in reducing concentrations in the treatment well but not widespread and the KGB system failed to operate and perform consistently (Baker/SBP, 1998).

A 1997 Feasibility Study (FS) by Baker analyzed remedial alternatives including: no action, institutional controls for soil and no action, institutional Land Use Controls (LUCs- **Figure 2-2**) and natural attenuation, groundwater extraction and; physical treatment, dual-phase vacuum extraction, and in-situ air stripping for groundwater. Soil and waste removal was determined not to be a viable option due to cost, safety, and logistical issues associated with the potential CA buried in the disposal trenches (Baker, 1998).

Based on the results for the FS, LUCs were selected as the interim remedy for soil, and the selected interim remedy for groundwater included institutional aquifer use controls and monitored natural attenuation (MNA). The remedy included five years of quarterly groundwater sampling of 24 monitoring wells, followed by 25 years of semi-annual sampling of 12 monitoring wells to be selected based on quarterly sampling results (Baker, 2000).

Between 1998 and 2005, long term monitoring (LTM) at IR Site 69 was conducted by Ecology and Environment, Inc. (E&E). Groundwater samples were collected from monitoring wells in the Surficial, upper Castle Hayne, and middle Castle Hayne aquifers. Analytical results indicated that vertical migration of VOCs into the upper Castle Hayne aquifer was occurring (E&E, 2005). In 2005, an optimization of the LTM Program was conducted and the LTM Optimization Report (CH2M HILL, 2005) recommended removal of IR Site 69 from the program, and performance of a Supplemental Investigation.

During the 2010 CH2M HILL Supplemental Investigation, surface soil, subsurface soil, surface water, sediment, and groundwater samples were collected to complete the delineation of site contamination. Analytical results from soil samples indicated concentrations of pesticides and metals in surface soil and metals in subsurface soil exceeding risk screening criteria; metals in surface water exceeding NCAC 2B (NC 2B) surface water standards; VOCs, semi-volatile organic compounds (SVOCs), pesticides, and metals in sediment exceeding risk screening criteria; and VOCs, pesticides, PCBs, and

metals in groundwater exceeding NC 2L standards. Concentrations of cis-1,2-DCE indicated the presence of a continuous contributing source and potential dense non-aqueous phase liquid (DNAPL) (CH2M HILL, 2010).

2.5 Regional Climate

The climate in the Onslow County area is characterized by short, mild winters with occasional short-duration cold periods and long, hot summers. Average annual net precipitation is approximately 50 inches. Ambient air temperatures generally range from 33 degrees to 53 degrees Fahrenheit (°F) in the winter months, and from 71°F to 88°F during the summer months. Winds are generally south-southwesterly in the summer and north-northwesterly in the winter (Water and Air Research, 1983). The hurricane season begins on June 1 and continues through November 30. Storms of non-tropical origin, such as frontal passages, local thunderstorms, and tornadoes, are more frequent and can occur year-round. Climate at MCB CamLej is discussed further in Section 1.4 of the MRP Master Project Plans (CH2M HILL, 2008a).

2.6 Regional Geology and Hydrogeology

Regional geology and hydrogeology at MCB CamLej are discussed in Sections 1.6 and 1.7 of the MRP Master Project Plans (CH2M HILL, 2008b).

Potable water available to MCB CamLej and the surrounding residential area is provided by water supply wells that pump groundwater from the Castle Hayne aquifer. Although freshwater is present within the surficial, Castle Hayne, Beaufort and Pee Dee aquifers, all of which are located below MCB CamLej, only the Castle Hayne aquifer is used by MCB CamLej as a water supply source (Cardinell et al., 1993).

No Base water supply wells are located in the Stone Bay area of MCB Camp Lejeune (AHEC, 2002) and the closest active supply well is more than 2 miles away from IR Site 69 across the New River. Offsite water supply for residential/commercial use is provided by the public utility, ONWASA.

Surface water runoff from Site UXO-02 flows into unnamed tributaries and wetlands of the New River. The New River flows into the Atlantic Ocean via New River inlet (MCB Camp Lejeune, 2002).

2.7 Site Geology and Hydrogeology

The intrusive sampling activities conducted during the Site UXO-02 PA/SI ranged from 7.5 feet below ground surface (ft bgs) to a maximum depth of approximately 20 ft bgs. However, previous investigations within IR Site 69 have characterized the geology and hydrogeology to depths of over 200 feet bgs (CH2MHILL, 2010). Consequently, this section also includes information obtained from IR Site 69, indicating that the underlying sediments consist of laterally discontinuous fine grained sediments consistent with those of the Surficial aquifer (Cardinell et al., 1993). Particle sizes noted from soil boring logs from temporary monitoring well installation activities indicate the Surficial aquifer at Site UXO-02 consists of sediments ranging from clay and silt to very fine- to fine-grained sand. Trends within the Site UXO-02 Surficial aquifer consists of predominantly sandy lean

clay in the northern portion of the site, grading to silty sand and poorly graded, fine-grained sand with lesser amounts of clayey sand and sandy silt toward the southern areas of the site. Below the Surficial aquifer is the Belgrade Formation confining unit comprising of silty clays with lesser amounts of sand with thicknesses ranging from 12-30 feet and thinning towards the east. Below the Belgrade Formation are the sand and limestone aquifers of the Castle Hayne Formation (upper, middle and lower aquifers respectively). The Castle Hayne Formation ranges from approximately 30 ft bgs to greater than 230 ft bgs; the greatest depth drilled at IR Site 69 (CH2MHILL, 2010).

Investigation-specific hydrogeologic information was derived from the installation of 28 shallow temporary monitoring wells, as detailed in Section 3.3.3. The variable topography of Site UXO-02 and surface water features affect the groundwater flow within the surficial aquifer. **Figure 2-3** depicts the potentiometric surface of the water table in March 2010, indicating that groundwater flow was generally to the northeast.

The potentiometric surface elevations (**Table 2-1**) range from 1.11 feet above mean sea level (ft msl) to 30.71 ft msl. Horizontal hydraulic gradients in March 2010 were found to range from 0.0349 feet per foot (ft/ft) in the central portion of the site, to 0.255 ft/ft in the vicinity of the bluffs overlooking the New River. The geometric mean hydraulic conductivity for the surficial aquifer at Site UXO-02 is estimated to be 0.662 ft/day (Baker, 1997). Transmissivity was calculated at 23.8 ft²/day using 36 feet as the maximum vertical extent of the Surficial aquifer (Baker, 1992). In March 2010, the average linear seepage velocity ranged from 0.066 to 0.483 ft/day, using an effective porosity for silty sands of 0.35 (Freeze and Cherry, 1979). Hydrogeological information is shown on **Tables 2-1 and 2-2**.

TABLE 2-1

Groundwater Elevation and Well Construction Information
 Site UXO-02, Unnamed Explosive Contaminated Range
 PA/SI Report
 MCB CamLej
 North Carolina

Well ID	Date Installed (mm/dd/yy)	Screened Interval (ft bgs)	Total Depth (ft bTOC)	Top of Casing Elevation (ft msl)	Ground Surface Elevation (ft msl)	Depth to Water March 2010 (ft bTOC)	Groundwater Elevation March 2010 (ft msl)
MR02-TW01	3/23/10	2-12	12	5.44	5.25	3.53	1.91
MR02-TW02	3/23/10	7-17	17	11.96	10.94	9.87	2.09
MR02-TW03	3/23/10	3-13	13	7.54	5.49	5.22	2.32
MR02-TW04	3/23/10	7-17	17	11.51	11.21	8.11	3.40
MR02-TW06	3/23/10	3-13	13	11.36	9.34	6.11	5.25
MR02-TW08	3/23/10	3-13	13	12.12	10.26	5.38	6.74
MR02-TW09	3/23/10	9-19	19	13.62	13.25	12.51	1.11
MR02-TW10	3/24/10	2-12	12	31.70	30.91	8.28	23.42
MR02-TW11	3/24/10	5-15	15	30.49	29.99	8.12	22.37
MR02-TW12	3/24/10	5-15	15	31.08	30.58	11.71	19.37
MR02-TW13	3/24/10	5-15	15	33.56	30.11	5.42	28.14
MR02-TW14	3/25/10	3-13	13	34.10	31.90	4.90	29.20
MR02-TW15	3/25/10	3-13	13	35.25	33.06	7.12	28.13
MR02-TW16	3/24/10	5-15	15	12.17	11.71	9.69	2.48
MR02-TW17	3/22/10	3-13	13	23.67	22.53	8.07	15.60
MR02-TW18	3/22/10	5-15	15	26.86	24.11	3.86	23.00
MR02-TW19	3/25/10	3-13	13	34.06	31.59	6.40	27.66
MR02-TW20	3/22/10	2-12	12	29.11	26.03	3.32	25.79
MR02-TW21	3/25/10	4-14	14	30.75	29.63	7.41	23.34
MR02-TW22	3/22/10	2-12	12	30.90	28.29	5.51	25.39
MR02-TW23	3/26/10	2-12	12	33.03	31.84	3.90	29.13
MR02-TW24	3/26/10	3-13	13	31.57	29.10	5.44	26.13
MR02-TW25	3/26/10	3-13	13	33.96	31.44	6.73	27.23
MR02-TW26	3/26/10	2-12	12	31.12	29.56	3.50	27.62
MR02-TW27	3/25/10	2-12	12	35.22	33.88	4.51	30.71
MR02-TW28	3/25/10	3-13	13	25.81	23.73	5.45	20.36
MR02-TW29	3/25/10	4-14	14	33.95	32.26	6.11	27.84
MR02-TW30	3/25/10	4-14	14	7.98	5.99	6.10	1.88
MR02-IR69-MW05	7/18/84	6-21	21	34.51	32.17	9.72	24.79
MR02-IR69-MW09	1/8/94	10-20	20	11.11	8.15	7.32	3.79
MR02-IR69-MW11	1/7/94	8.5-18.5	18.5	27.43	24.84	5.42	22.01
MR02-IR69-MW12	1/6/94	2.5-12.5	12.5	9.74	7.46	3.50	6.24
MR02-IR69-MW13	5/24/94	3-13	13	36.87	34.94	4.18	32.69
MR02-IR69-MW14	12/17/94	3-13	13	33.73	31.84	5.05	28.68
MR02-IR69-MW15	3/23/95	3-13	13	35.92	34.67	2.13	33.79

Notes:

ft bgs = feet below ground surface

ft bTOC = feet below top-of-casing

ft msl = feet above mean sea level

MR02-TW05 and MR02-TW06 were not installed

Prepared by: Verd Anna Cunningham

Checked by: Maggie Radford

TABLE 2-2

Site UXO-02 Hydrogeological Data

Site UXO-02, Unnamed Explosive Contaminated Range

PA/SI Report

MCB CamLej

North Carolina

Point	Groundwater Elevation from Potentiometric Map (ft msl)	Gradient (ft/ft)	Hydraulic Conductivity (ft/day)*	Transmissivity (ft ² /day)**	Seepage Velocity (ft/day)***
A	24.00	0.0349	0.662	23.8	0.066
B	0.00				
C	24.00	0.2553			0.483
D	0.00				

ft bgs = feet below ground surface

ft bTOC = feet below top-of-casing

ft msl = feet above mean sea level

N/A = not applicable

* Average K from 3 surficial aquifer wells reported in the Baker RI Report (1992)

** Value calculated using a maximum depth of 36ft for the surficial aquifer at Site 69 (Baker RI Report 1992)

*** Value calculated using an effective porosity of 0.35 representing silty sands (Freeze & Cherry, 1979)

Maximum

Minimum

Prepared by: V. Cunningham

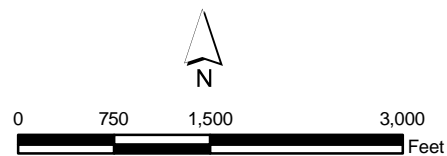
Checked by: D. Seed



Legend

- Wetland Area
- Site 69 Expanded RI DGM
- Site UXO-02
- Installation Boundary

Aerial Photography date 2009



1 inch = 1,500 feet

Figure 2-1
 Site UXO-02 Location Map
 Site UXO-02 Unnamed Explosive Contaminated Range
 PA/SI Report
 MCB CamLej
 North Carolina





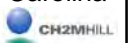
Legend

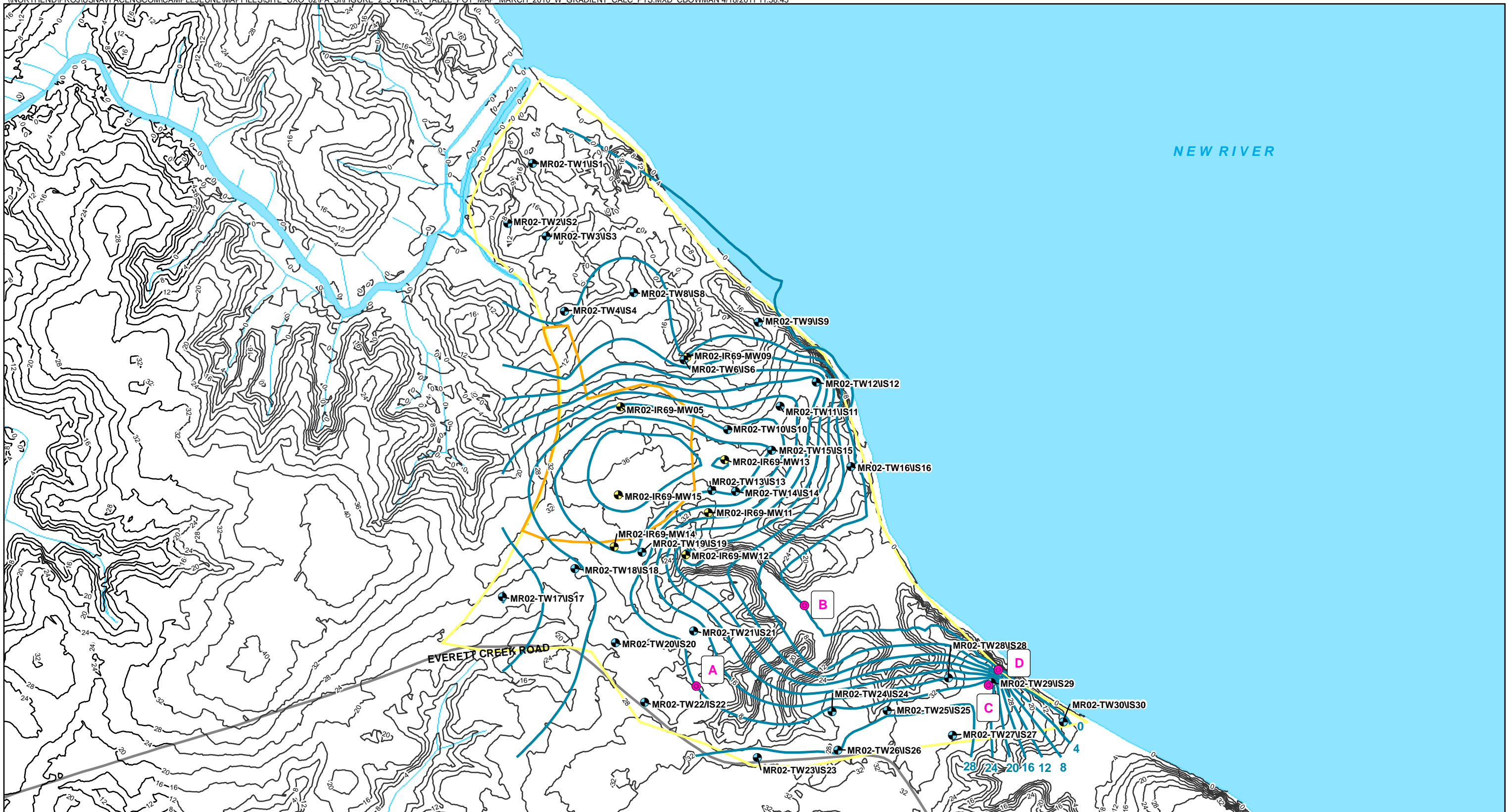
- Aquifer Use Control Boundary
- Intrusive Activities Control Boundary (Soil)
- Intrusive Activities Control Boundary (Groundwater)
- Site UXO-02
- Site 69

Figure 2-2
Land Use Controls
Site UXO-02 Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

0 300 600 1,200
Feet

1 inch = 600 feet





- Legend**
- Gradient Calculation Points
 - Monitoring Wells & Soil Boring Location Data
 - Groundwater Sampling Location within Site 69
 - UXO-02 Groundwater Contours
 - Elevation Contour (4 ft interval)
 - Streams
 - Road
 - Site 69 Boundary
 - Site UXO-02 Boundary

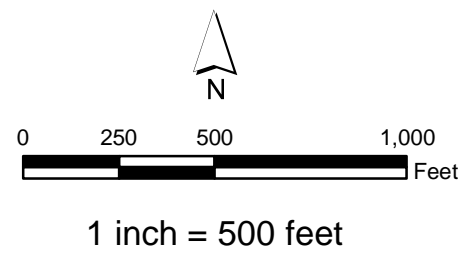


Figure 2-3
Potentiometric Surface Map of the Water Table (March 2010)
Site UXO-02 Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina



Field Investigation Activities

The initial site reconnaissance, surveying, vegetation clearing, and digital geophysical mapping (DGM) field activities were completed in February 2010. The environmental field sampling activities were conducted in February and March 2010.

Field activities were conducted in accordance with the Sampling and Analysis Plan (CH2M HILL, 2009a). The technical approach included in the Sampling and Analysis Plan was developed by the MCB CamLej Tier I Partnering Team, which includes representatives from the United States Navy, MCB CamLej, United States Environmental Protection Agency (USEPA) Region 4, and North Carolina Department of Environment and Natural Resources (NCDENR).

3.1 Site Preparation and Support

3.1.1 MEC Avoidance

Due to the potential presence of MEC, avoidance measures were implemented in accordance with the Explosives Safety Submission (ESS) Determination (Marine Corps Systems Command [MARCORSYSCOM], 2009). Unexploded ordnance (UXO) technicians qualified in accordance with Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP) 18 provided MEC escort and avoidance services to the surveying, vegetation clearing, geophysical surveying, utility locating, and direct push technology (DPT) subcontractors. During field activities in the southeastern portion of Site UXO-02, material potentially presenting an explosive hazard (MPPEH) was encountered at the ground surface. The item was identified as an unfired U.S. SIGNAL, AIRCRAFT, AN-M43 (Red Star) signal flare. MCB CamLej Explosive Ordnance Disposal (EOD) was contacted and immediately removed the MPPEH to an offsite location.

3.1.2 Site Survey

Land surveying was conducted in accordance with the MRP Master Project Plans (CH2M HILL, 2008a). SEPI Engineering, a North Carolina-licensed surveyor from Raleigh, North Carolina, conducted the site surveying activities in two phases, as described below.

Phase 1 consisted of delineating the site boundary and DGM area layout. The surveyor prominently marked the boundaries of the project area using flagging tape and wooden stakes, and provided all survey results to CH2M HILL. The site boundary was provided by MCB CamLej geographic information system (GIS) personnel using the 1946 Range Overlay Map (USACE, 2001, Plate 4). The surveyor also facilitated preparation of the site for DGM by establishing transects for DGM surveys, and provided the survey results for incorporation into the DGM subcontractor's GIS.

Phase 2 consisted of surveying the location of temporary groundwater monitoring wells after the completion of environmental sampling activities. Temporary monitoring well locations were surveyed from top of casing (TOC) and ground surface.

3.2 Digital Geophysical Mapping

DGM was performed at Site UXO-02 to evaluate the frequency and distribution of geophysical anomalies that could potentially represent subsurface MEC. The DGM was performed by subcontractor NAEVA Geophysics of Charlottesville, Virginia, with quality control (QC) being performed by both NAEVA and CH2M HILL's munitions response (MR) QC geophysicist. A summary of the work performed is provided below; the Geophysical Investigation Report is provided in **Appendix C**.

3.2.1 Digital Geophysical Mapping Survey

Prior to conducting the DGM survey at Site UXO-02, the land surveyor installed survey stakes along 260 DGM transects (**Figure 3-1**). The stakes were used as fiducial markers during the DGM survey. Approximately 14 acres of the Site 69 area, as delineated by the Site 69 fenced boundary, was excluded from the DGM survey, in accordance with the Sampling and Analysis Plan (CH2M HILL, 2009a). Therefore, the total area available for the DGM survey totaled approximately 110 acres.

The DGM survey was conducted using a Geonics EM61-MK2 (EM61) Electromagnetic (EM) high-sensitivity metal detector operated in wheel mode configuration. 32 of the 110 acres of Site UXO-02 were not surveyed due to steep topography, standing water and wetlands. Due to the inaccessibility of these portions of the site, the DGM survey was divided into four blocks: the northeastern (Site UXO-02_1), middle (Site UXO-02_2), western (Site UXO-02_3), and southern (Site UXO-02_4) areas. DGM transects were spaced approximately 7 meters (m) apart, as site conditions allowed.

Additional DGM surveys were conducted within IR Site 69 area of Site UXO-02 to assess the extent of previous landfill-related activities. Results from these investigations are reported in *Draft Supplemental Investigation, Site 69, Operable Unit No. 14 – Rifle Range Chemical Dump* (CH2M HILL, 2010).

Prior to the start of DGM activities, instrument verification was performed at an existing geophysical prove-out (GPO) plot to confirm that the selected geophysical equipment met the project data quality objectives (DQOs). The verification was conducted at the existing test plot set up and seeded by CH2M HILL at the former Knox Trailer Park (Site UXO-04). **A threshold of 3 millivolts (mV) in Channel 2 was chosen for the selection of geophysical anomalies because this value represented the minimum instrument response at which a metallic item could be positively distinguished from signal noise.** The GSV was conducted in accordance with Appendix B of the PA/SI Work Plan Addendum (CH2M HILL, 2009b). The results were reviewed by the onsite CH2MHILL QC Geophysicist and showed good correlation to previous surveys of the same plot and appropriate responses for the buried items. The Geophysical Investigation Report is presented in **Appendix C**.

3.2.2 Data Quality Objectives

All DQOs outlined in the PA/SI Work Plan Addendum (CH2M HILL, 2009b) were met during the DGM survey.

3.2.3 Quality Control

An extensive QC program was applied to the DGM operations at the site. **Figure 3-2** shows an overall chart of the QC steps.

The geophysical system was field tested as specified in the PA/SI Work Plan Addendum (CH2M HILL, 2009b). A summary of the tests performed is presented in **Table 3-1**. Both NAEVA and CH2M HILL performed QC checks of geophysical data and data deliverables at each step of the processing path.

All tests outlined in the PA/SI Work Plan Addendum (CH2M HILL, 2009b) were performed on the DGM instruments at the appropriate intervals (e.g., daily, weekly, at start of project). The results were checked by NAEVA's QC geophysicist prior to delivery to CH2M HILL and subsequently checked by the CH2M HILL QC geophysicist.

3.3 Environmental Investigation Activities

During the development of the Sampling and Analysis Plan (CH2M HILL, 2009a), there was a lack of historical information to identify specific areas of potential concern at Site UXO-02. In the absence of evidence to bias the sampling activities, sample locations were distributed evenly across accessible areas of the site.

Environmental samples were collected in accordance with the Sampling and Analysis Plan (CH2M HILL, 2009a). MEC avoidance procedures were observed and a UXO technician provided escort during sampling.

All environmental media analytical data were validated by Environmental Data Services, Inc. of Williamsburg, Virginia.

3.3.1 Surface Soil Sampling

Surface soil sampling was conducted by CH2M HILL personnel during February and March 2010. A total of 184 surface soil samples (MR02-SS01 through MR02-SS184) were collected from the portion of Site UXO-02 located outside the fenced perimeter of IR Site 69. Due to the potential presence of chemical agent within IR Site 69, the 21 surface samples (MR02-IR69-SS01 through MR02-IR69-SS21) collected from within the IR Site 69 area were collected during the SI field activities (February and March 2010) conducted under CTO-081. All 205 surface soil samples were collected using the TR-02-1 approach, as described in the Sampling and Analysis Plan (CH2M HILL, 2009a), which consisted of compositing a minimum of 30 sample aliquots from random locations within each 1-m by 1-m sampling location, at depths from 0 to 2 inches bgs. Surface soil sampling locations are shown on **Figure 3-3** and are located within the 4 cleared vegetation blocks used for DGM for safe accessibility.

All surface soil samples were submitted to Katahdin Analytical in Scarborough, Maine, and analyzed for the following:

- Explosives residues, including pentaerythritol tetranitrate (PETN) (SW-846 USEPA Method 8330) and nitroglycerine (SW-846 USEPA Method 8332)
- Perchlorate (SW-846 USEPA Method 6850)
- Target Analyte List (TAL) metals (SW-846 USEPA Method 6010B)

3.3.2 Subsurface Soil Sampling

Subsurface soil sampling at locations outside the fenced perimeter of IR Site 69 was accomplished through use of a DPT drill rig operated by Probe Technologies, Inc., of Concord, North Carolina. Intrusive sampling activities at Site UXO-02, including IR Site 69, were conducted in concert with the SI field effort in March 2010 that utilized roto sonic drilling equipment. A total of 31 subsurface soil samples were collected from an unsaturated portion of the soil core located immediately above the estimated water table at depths ranging from 1 to 9 ft bgs. The DPT sampling method utilized an open core barrel sampling device along with disposable acetate liners. Sampling equipment was decontaminated between borings and new liners were used to retrieve each successive soil core. The soil cores retrieved from these borings were examined and logged by the CH2M HILL geologist to record soil information in accordance with the Sampling and Analysis Plan (CH2M HILL, 2009a). Soil boring logs are provided in **Appendix D**, and sampling locations are shown in **Figure 3-4**.

Subsurface soil samples were submitted to Katahdin Analytical and analyzed for the following analytes:

- Explosives residues, including PETN (SW-846 USEPA Method 8330) and nitroglycerine (SW-846 USEPA Method 8332)
- Perchlorate (SW-846 USEPA Method 6850)
- TAL metals (SW-846 USEPA Method 6010B)

3.3.3 Temporary Well Installation

During the DPT investigation, 28 temporary groundwater monitoring wells (MR02-TW01 through MR02-TW30) were installed. MR02-TW05 and MR02-TW07 were originally to be installed within the fenced boundary of IR Site 69 during that project's expanded site investigation; however, it was determined that these wells would not be installed and that additional groundwater samples would be collected from existing monitoring wells in and around the fence boundary. **Figure 3-4** shows the temporary well locations, and **Table 2-1** summarizes the well construction details. The total depths of the temporary wells installed at Site UXO-02 ranged from 9 to 19 ft bgs. The temporary wells were screened to bracket the water table.

Each temporary well was constructed with 1-inch inside diameter Schedule 40 polyvinyl chloride (PVC) screen and riser. Each well was also equipped with a pre-packed sand filter retained by a 120-mesh sleeve attached to the screened interval, to reduce turbidity. Each well screen consisted of a 10-ft length of 0.010-inch machine slotted Schedule 40 PVC. Silica filter sand was placed around the annular space of the well screen from the bottom of the boring extending to a depth of 2 ft above the top of the screen. A layer of bentonite granules was placed above the top of the sand pack extending to the ground surface. A locking watertight cap was placed on the PVC pipe and the wells were clearly labeled. Well completion diagrams are presented in **Appendix D**.

The temporary wells were developed using disposable bailers and peristaltic pumps. Development continued until the water was visually clear, ideally with turbidity below 10 Nephelometric turbidity units (NTU), and water quality parameters had stabilized. Six

wells were pumped dry during development, prior to stabilization of parameters and acceptable turbidity levels. If three well volumes had been purged prior to the well going dry, it was considered developed. If three well volumes had not been purged prior to the well going dry, it was allowed to equilibrate for 24 hours before another attempt at development. All of the wells were developed the day following installation. Following development, the wells were allowed to equilibrate for at least 24 hours before sampling.

3.3.4 Groundwater Sampling

Groundwater samples were collected from each of the 28 temporary monitoring wells in March and April 2010. Groundwater samples were also collected from 7 existing monitoring wells (MR02-IR69-MW05, 09, 11,12, 13, 14 and 15) in February and March 2010. Prior to well purging and sampling, water level measurements were recorded from each temporary well (**Table 2-1**).

When possible, groundwater samples were collected using a peristaltic pump equipped with disposable polyethylene tubing and low-flow purging and sampling techniques in accordance with the Sampling and Analysis Plan (CH2M HILL, 2009a). However, five wells (MR02-TW06, MR02-TW08, MR02-TW12, MR02-TW16 and MR02-TW17) exhibited such low yields that they were purged to dryness and did not recover sufficiently to allow sample collection for several hours. To minimize turbidity in the samples collected from these wells, each well was purged to dryness and a new, clean disposable bailer was suspended within 1 foot of the bottom of the well. After the well was allowed to recover overnight, the bailer was slowly removed and the sample decanted into laboratory-supplied containers for TAL metals analysis. After the bailer was emptied, a peristaltic pump was used with polyethylene tubing and low-flow sampling techniques to fill the remaining required bottle-ware. A field-filtered sample for dissolved metals analysis was also collected from each of the five low-yield wells for comparison with the TAL total metals results.

Water quality parameters (specific conductance, pH, turbidity, temperature, dissolved oxygen [DO], and oxidation-reduction potential [ORP]) were measured during the purging phase using a YSI® Model 556 water quality meter and Hanna® turbidimeter and recorded in field documents. Field parameters are summarized in **Table 3-2**. Groundwater sampling data sheets are provided in **Appendix E**. Groundwater samples collected using traditional low-flow purging and sampling techniques were collected only after all field parameters had stabilized over three successive readings and at least one well volume had been purged, or at least three well volumes had been purged from the well. Parameters were considered stabilized over three successive readings when successive measurements agreed as follows:

- pH within 0.1 pH units
- Temperatures constant
- Conductivity within 10 percent
- Turbidity within 10 percent or as low as practicable given sampling conditions

Prior to sample collection, the water quality meter flow-through cell was disconnected from the peristaltic pump so that the pump discharge flowed directly into the laboratory-supplied sample bottles. New pump tubing was used for purging and sampling each well.

Once sample collection was complete, the sample bottles were placed in iced coolers and prepared for shipment under chain-of-custody control to Katahdin Analytical, and analyzed for the following analytes:

- Explosives residues, including PETN (SW-846 USEPA Method 8330) and nitroglycerine (SW-846 USEPA Method 8332)
- Perchlorate (SW-846 USEPA Method 6850)
- TAL total metals (SW-846 USEPA Method 6010B)

Additional samples were collected from 20 of the temporary monitoring wells (-TW06, -TW08, -TW10, -TW12, -TW16, -TW17, -TW18, -TW22, -TW24, -TW25, -TW26, -TW29, -TW30, and 7 pre-existing wells for analysis of:

- Dissolved metals (SW-846 USEPA Method 6010B)

Following sampling and surveying, all temporary wells were abandoned by Probe Technologies, in accordance with North Carolina well construction standards.

3.3.5 Surface Water and Sediment Sampling

Ten surface water and 10 sediment samples were collected at co-located sites within Site UXO-02 on February 8-9, 2010. The samples, designated MR02-SW01/SD01 through MR02-SW10/SD10, were collected from the locations shown on **Figure 3-5**. The sampling locations were not surveyed, but the location coordinates were identified using a handheld global positioning system (GPS) unit.

Surface water samples were collected before the sediment samples using a peristaltic pump to reduce turbidity. Surface water parameter readings were also collected to aid in ecological risk screening. Sediment samples were collected by advancing a trowel approximately 6–12 inches into the sediment and then homogenizing the sample. Both surface water and sediment samples were collected from downstream to upstream to avoid cross-contamination by sediment suspension.

In accordance with the Sampling and Analysis Plan (CH2M HILL, 2009a), all surface water samples were submitted to Katahdin Analytical and analyzed for the following:

- Explosives residues, including PETN (SW-846 USEPA Method 8330) and nitroglycerine (SW-846 USEPA Method 8332)
- Perchlorate (SW-846 USEPA Method 6850)
- TAL total and dissolved metals (SW-846 USEPA Method 6010B)

In accordance with the Sampling and Analysis Plan (CH2M HILL, 2009a), all sediment samples were submitted to Katahdin Analytical and analyzed for the following:

- Explosives residues, including PETN (SW-846 USEPA Method 8330) and nitroglycerine (SW-846 USEPA Method 8332)
- Perchlorate (SW-846 USEPA Method 6850)
- TAL metals (SW-846 USEPA Method 6010B)

3.3.6 Quality Assurance/Quality Control Sampling

Appropriate quality assurance (QA)/QC sampling was performed in accordance with Navy CLEAN and CH2M HILL protocols, including field blanks, equipment blanks, duplicates, and matrix spike/matrix spike duplicates (MS/MSDs). Required QA/QC samples and the frequency of collection are shown in **Table 3-3**.

3.4 Investigation-derived Waste Management

Investigation-derived waste (IDW) was managed and disposed of in accordance with the Base Waste Management Plan (CH2M HILL, 2008b). IDW generated during field events consisted of well development and purge water, decontamination fluids, disposable equipment, and personal protective equipment (PPE). Soil from the borings was spread around the boreholes. Liquid wastes were placed in labeled 55-gallon drums and staged at the 90-day storage facility on Parachute Tower Road. Disposable equipment, including PPE, plastic sheeting, paper towels, and aluminum foil, was placed in black contractors trash bags and disposed of in an onbase dumpster.

3.5 Site Survey

Following completion of sampling activities, SEPI Engineering surveyed horizontal coordinates for all subsurface soil sampling locations, casing elevations, and ground elevations for the 28 temporary wells. Elevations were accurate to the nearest 0.01 ft (0.1 ft for unpaved ground surface) and tied to the nearest North American Vertical Datum of 1988 (NAVD 88) benchmark. Horizontal controls were based on the metric system and referenced to the North American Datum of 1983 (NAD83) and the Universal Transverse Mercator (UTM) grid system.

TABLE 3-1

DGM Instruments Standardization Tests and Acceptance Criteria

Site UXO-02, Unnamed Explosive Contaminated Range

PA/SI Report

MCB CamLej

North Carolina

Test	Test Description	Acceptance Criteria	Power On	Beginning of Day	Beginning and End of Day	First Time Instr. Used	2% of Total Area Surveyed
1	Equipment Warm-up	Equipment specific (minimum 10 min)	X	X			
2	Personnel Test	Based on instrument used. Personnel, clothing, etc. should have no effect on instrument response. <2 mV		X			
3	Vibration Test (Cable Shake)	Data profile does not exhibit data spikes. <2 mV		X			
4	Static Background & Static Spike	+/- 20% of standard item response, after background correction			X		
5	Instrument Verification Strip	Repeatability of response amplitude +/-20%, Positional Accuracy +/- 20 cm		X			
6	Dynamic Test (EM31 only)	Record a significant response and ensure proper functionality				X	
7	Repeat Data	Repeatability of response amplitude					X

Prepared by: Verd Anna Cunningham/RDU

Checked by: Andrew Gascho/DEN

TABLE 3-2

Groundwater Field Parameters

Site UXO-02, Unnamed Explosive Contaminated Range

PA/SI Report

MCB CamLej

North Carolina

Station ID	MR02-TW01	MR02-TW02	MR02-TW03	MR02-TW04	MR02-TW06*	MR02-TW08*	MR02-TW09	MR02-TW10	MR02-TW11	MR02-TW12*
Sample Date	3/30/2010	3/30/2010	3/30/2010	3/31/2010	3/31/2010	4/1/2010	3/30/2010	3/31/2010	3/30/2010	3/31/2010
Field Parameters										
Dissolved Oxygen (mg/L)	0.77	0.69	0.65	1.08	5.53	7.96	0.96	2.51	1.06	ND
Oxidation Reduction Potential (mV)	127.2	94.1	138.7	170.5	273	166.2	-48	243.4	137.8	ND
pH	6.01	5.06	5.46	5.59	5.06	5.57	4.48	4.46	4.76	ND
Specific Conductance (mS/cm)	0.354	0.335	0.327	0.152	0.066	0.071	0.604	0.086	0.225	ND
Temperature (°C)	14.81	17.32	15.32	15.94	16.05	13.44	16.89	13.61	15.09	ND
Turbidity (NTU)	9.18	1.4	9.22	2.9	>1000	>1000	6.76	60	7.82	ND

* Sample collected from low-yield well using a bailer

ND - no data

Prepared by: Verd Anna Cunningham

Checked by: Maggie Radford

TABLE 3-2

Groundwater Field Parameters

Site UXO-02, Unnamed Explosive Contaminated Range

PA/SI Report

MCB CamLej

North Carolina

Station ID	MR02-TW13	MR02-TW14	MR02-TW15	MR02-TW16*	MR02-TW17*	MR02-TW18	MR02-TW19	MR02-TW20	MR02-TW21	MR02-TW22
Sample Date	3/30/2010	3/30/2010	3/29/2010	4/1/2010	3/30/2010	3/31/2010	3/29/2010	3/29/2010	3/29/2010	3/29/2010
Field Parameters										
Dissolved Oxygen (mg/L)	1.62	1.86	4.10	9.44	8.97	1.62	5.15	1.12	1.52	1.09
Oxidation Reduction Potential (mV)	212.6	180.5	46.9	111	187.7	175.1	309.3	216.4	-15.7	152.2
pH	4.17	4.54	3.99	5.97	7.73	5.12	3.81	4.17	4.46	4.48
Specific Conductance (mS/cm)	0.178	0.055	0.071	0.265	0.381	0.102	0.042	0.084	0.068	0.093
Temperature (°C)	12.79	13.46	15.82	14.07	15.1	13.44	13.66	14.38	13.69	13.66
Turbidity (NTU)	10	3.7	1.5	120	75	13.1	45.4	23	8.37	200

* Sample collected from low-yield well using a bailer

ND - no data

Prepared by: Verd Anna Cunningham

Checked by: Maggie Radford

TABLE 3-2

Groundwater Field Parameters

Site UXO-02, Unnamed Explosive Contaminated Range

PA/SI Report

MCB CamLej

North Carolina

Station ID	MR02-TW23	MR02-TW24	MR02-TW25	MR02-TW26	MR02-TW27	MR02-TW28	MR02-TW29	MR02-TW30	MR02-IR69-GW05
Sample Date	3/30/2010	3/31/2010	3/31/2010	3/30/2010	3/31/2010	3/31/2010	3/31/2010	3/31/2010	3/8-3/9/10
Field Parameters									
Dissolved Oxygen (mg/L)	1.04	2.56	3.41	0.28	3.21	0.76	2.74	1.74	1.63
Oxidation Reduction Potential (mV)	131.5	-3.8	74.2	111.9	17.7	258.4	1.5	-31.7	285
pH	4.11	5.21	5.82	4.2	4.17	4.29	5.27	5.31	4.57
Specific Conductance (mS/cm)	0.067	0.139	0.187	0.114	0.151	0.05	0.279	0.3	0.04
Temperature (°C)	14.7	15.31	15.18	14.21	14.78	12.6	15.86	15.77	14.45
Turbidity (NTU)	29	650	369	130	8.23	16	60	140	4.16

* Sample collected from low-yield well using a bailer

ND - no data

Prepared by: Verd Anna Cunningham

Checked by: Maggie Radford

TABLE 3-2

Groundwater Field Parameters

Site UXO-02, Unnamed Explosive Contaminated Range

PA/SI Report

MCB CamLej

North Carolina

Station ID	MR02-IR69-GW09	MR02-IR69-GW11	MR02-IR69-GW12	MR02-IR69-GW13	MR02-IR69-GW14	MR02-IR69-GW15
Sample Date	3/1/2010	3/1/2010	2/27/2010	3/1/2010	2/28/2010	3/7/2010
Field Parameters						
Dissolved Oxygen (mg/L)	3.29	0.94	0.63	0.50	1.93	0.28
Oxidation Reduction Potential (mV)	260.9	354.1	22	65.9	248.1	13.5
pH	5.26	4.21	4.95	4.69	4.95	5.33
Specific Conductance (mS/cm)	0.106	0.44	0.051	0.045	0.063	0.438
Temperature (°C)	15.39	13.8	11.61	11.09	9.75	10.89
Turbidity (NTU)	28.3	4.72	5.51	9	8	23

* Sample collected from low-yield well using a bailer

ND - no data

Prepared by: Verd Anna Cunningham

Checked by: Maggie Radford

TABLE 3-3
QA/QC Sampling Program
Site UXO-02, Unnamed Explosive Contaminated Range
MCB CamLej
North Carolina

Analysis	Sample Matrix	Field Samples	Field Duplicates	Equipment Blanks	Field Blanks	MS/MSDs
Subsurface Soil						
Explosives Residues, including PETN and Nitroglycerine	Solid	31	3	3	2	2
Perchlorate		31	3	3	2	2
Total Metals		31	3	3	2	2
Surface Soil						
Explosives Residues, including PETN and Nitroglycerine	Solid	205	21	10	3	11
Perchlorate		205	21	10	3	11
Total Metals		205	21	10	3	11
Groundwater (Temporary Well)						
Explosives Residues, including PETN and Nitroglycerine	Aqueous	28	3	2	1	2
Perchlorate		28	3	2	1	2
Total Metals		28	3	2	1	2
Dissolved Metals ¹		13	0	2	1	0
Groundwater (Permanent Well)						
Explosives Residues, including PETN and Nitroglycerine	Aqueous	7	1	1	1	1
Perchlorate		7	1	1	1	1
Total Metals		7	1	1	1	1
Dissolved Metals		7	1	1	1	1
Sediment						
Explosives Residues, including PETN and Nitroglycerine	Solid	10	1	1	1	1
Perchlorate		10	1	1	1	1
Total Metals		10	1	1	1	1

TABLE 3-3
 QA/QC Sampling Program
Site UXO-02, Unnamed Explosive Contaminated Range
MCB CamLej
North Carolina

Analysis	Sample Matrix	Field Samples	Field Duplicates	Equipment Blanks	Field Blanks	MS/MSDs
Pore/Surface Water						
Explosives Residues, including PETN and Nitroglycerine	Aqueous	10	1	1	1	1
Perchlorate		10	1	1	1	1
Total Metals		10	1	1	1	1
Dissolved Metals		10	1	1	1	1

Notes:

MS/MSD = Matrix Spike and Matrix Spike Duplicate pair

Field duplicates are collected at the rate of 1 for every 10 environmental samples

Equipment rinsate blanks are typically collected at the rate of 1 per day per media

Field blanks are typically collected at the rate of 1 per week during sampling

MS/MSDs are collected at the rate of 1 for every 20 samples

¹ Samples collected due to high turbidity encountered in 13 temporary monitoring wells

Created by: Verd Anna Cunningham/RDU

Checked by: Simon Kline



- Legend**
- Approximate DGM Transect
 - UXO-02 Sampling Areas
 - Wetland Area
 - Site 69
 - Site UXO-02

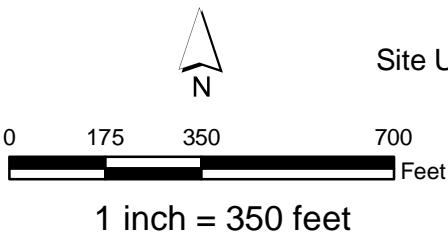


Figure 3-1
DGM Transects
Site UXO-02 Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina



Aerial Photography date 2009

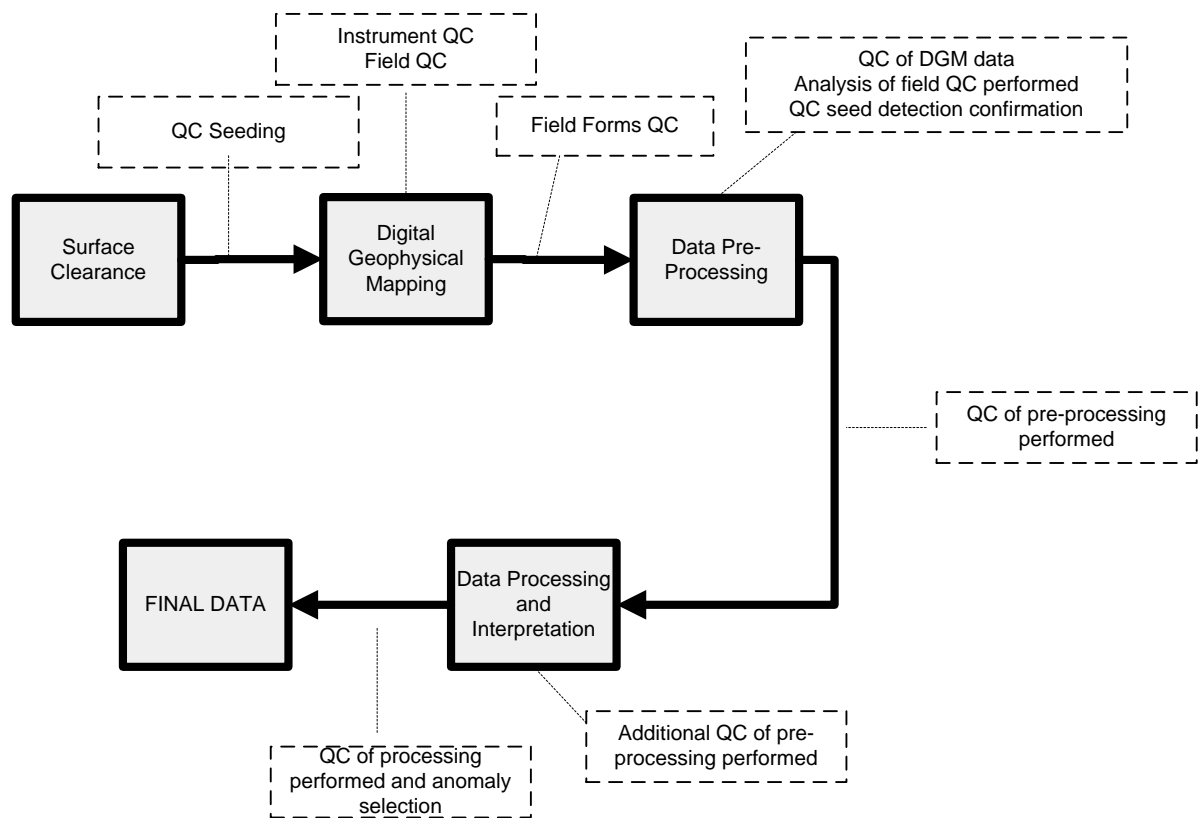


FIGURE 3-2
 Overview of DGM QC Process
 Site UXO-02 Unnamed Explosive Contaminated Range
 PA/SI Report
 MCB CamLej
 North Carolina



Legend

- Surface Soil Sampling Location within Site 69
- Surface Soil Sampling Location
- Site UXO-02
- Site 69



Figure 3-3
Surface Soil Sampling Locations
Site UXO-02 Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Aerial Photography date 2009

Generated By: Susan Forker/RDU Checked by: Simon Kline/RDU





Legend

- Subsurface Soil/Groundwater Sampling Location
- Subsurface Soil Sampling Location within Site 69
- Groundwater Sampling Location within Site 69
- Site UXO-02
- Site 69

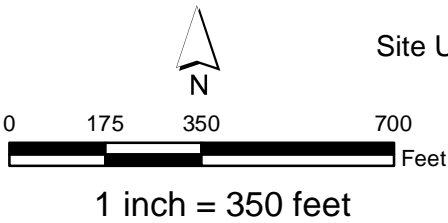


Figure 3-4
Subsurface Soil/Groundwater Sampling Locations
Site UXO-02 Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina



Legend

- ▲ Sediment/Surface Water Sampling Location
- Planning Wetlands at UXO-02
- Site UXO-02
- Site 69

Aerial Photography date 2009

Generated By: Susan Forker/RDU Checked by: Simon Kline/RDU

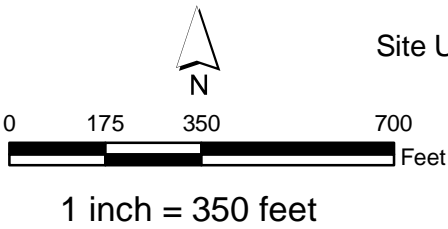


Figure 3-5
Sediment/Surface Water Sampling Locations
Site UXO-02 Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina



Investigation Results

This section presents the findings of the investigative activities conducted at Site UXO-02 during February and March 2010.

4.1 Digital Geophysical Mapping

The Site UXO-02 DGM survey covered approximately 11.3 acres of the 110-acre portion of Site UXO-02 that excludes IR Site 69 using 130 two-pass transects (**Figure 4-1**). Transects were truncated within these blocks by fallen trees, steep terrain and smaller areas of wetlands diminishing DGM coverage. A total of 1,457 geophysical anomalies with a signal greater than 3 mV, which is representative of potential subsurface MEC, were identified within the survey area. **Figure 4-1** illustrates the DGM area and the distribution of anomalies observed with a signal greater than 3 mV. Anomalies representing potential subsurface MEC were identified in each of the four survey areas, with a widespread distribution throughout Site UXO-02. **Appendix C** contains the Geophysical Investigation Report.

4.2 Environmental Investigation

The following subsections summarize the laboratory analytical data for the soil, groundwater, surface water, and sediment samples collected at Site UXO-02. Laboratory analytical data are presented in **Appendix F**.

Following the third-party data validation of the laboratory analytical data, surface and subsurface soil samples were screened against the following standards:

- North Carolina soil screening levels (NC SSLs)
- Adjusted¹ USEPA Industrial and Residential Regional Screening Levels (RSLs) for Chemical Contaminant Tables (USEPA, 2010a)
- MCB CamLej background soil concentrations (two times the mean base background soil concentration), available for metals only (Baker, 2001).

The January 2010 USEPA RSLs replaced the 2008 RSLs, which were the proposed screening criteria in the Sampling and Analysis Plan (CH2M HILL, 2009a). The RSLs for non-carcinogenic compounds were adjusted by dividing by 10 to conservatively account for exposure to multiple analytes. The methodology for calculating NC SSLs for contaminant migration from soil to groundwater was developed to identify chemical concentrations in soil that have the potential to impact groundwater. The NC SSLs are back-calculated from acceptable groundwater concentrations and take into consideration fate and transport parameters (NCDENR, 2010a).

¹ Based on noncarcinogenic effects to conservatively account for exposure to multiple constituents

Figure 4-2 illustrates the locations of the surface soil samples where target analytes were detected at concentrations greater than twice the mean base background concentration and greater than at least one of the screening levels (NC SSLs or the Adjusted RSLs). **Figure 4-3** depicts the locations of subsurface soil samples that contained target analytes greater than twice the mean base background concentration and greater than at least one of the screening levels (NC SSLs or the Adjusted RSLs). The detected concentrations of specific target analytes are summarized in **Tables 4-1 and 4-2**.

Surface Soil

- **Explosives Residues**

- **Nitroglycerin** was the only explosives residue detected, found in sample MR02-IR69-SS17-10A at 860 J micrograms per kilogram [$\mu\text{g}/\text{kg}$] and in exceedance of the Adjusted Residential Soil RSL (610 $\mu\text{g}/\text{kg}$). Explosives residues were not detected in samples collected from the portion of Site UXO-02 situated outside the fenced perimeter of IR Site 69.

- **Perchlorate** was not detected in any of the surface soil samples collected from Site UXO-02.

- **Metals**

Table 4-1 presents a summary of the metals that exceeded screening criteria in samples collected from the area of Site UXO-02 outside the fenced perimeter of IR Site 69.

Table 4-2 indicates the metals that exceeded screening criteria in samples collected from the area of Site UXO-02 inside the fenced perimeter of IR Site 69.

Subsurface Soil

- **Explosives residues** and **perchlorate** were not detected in any of the subsurface soil samples collected from Site UXO-02.

- **Metals**

Table 4-3 indicates the metals that exceeded screening criteria in samples collected from the area of Site UXO-02 outside the fenced perimeter of IR Site 69. **Table 4-4** indicates the metals that exceeded screening criteria in samples collected from the area of Site UXO-02 inside the fenced perimeter of IR Site 69.

4.2.1 Groundwater

This section presents the results of laboratory analysis of groundwater samples collected from the 28 shallow temporary monitoring wells and the 7 permanent monitoring wells located within the perimeter of IR Site 69. Groundwater results were screened against the NC Administrative Code Title 15A, Subchapter 2L Groundwater Quality Standards (NC 2L Standards) (NCDENR, 2010b), USEPA Tap Water RSLs, and MCB CamLej background groundwater concentrations (twice the mean base background groundwater concentration), which were available for inorganic analytes only (Baker, 2002). The NC 2L Standards are the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state that may be tolerated without creating a threat to human health or otherwise rendering the groundwater unsuitable for its intended purpose.

Tables 4-5 and 4-6 present a summary of the laboratory analytical results for the samples collected from Site UXO-02. **Figure 4-4** depicts the locations of groundwater samples that contained target analytes at concentrations greater than twice the mean base background concentration and greater than at least one of the screening levels (i.e., NC 2L Standards or USEPA Tap Water RSLs).

For the ecological risk assessment and from wells that exhibited elevated turbidity readings, both total and dissolved metals samples were collected from 13 of the Site UXO-02 wells and one of the IR Site 69 wells.

- **Explosives residues and perchlorate** were not detected in any of the groundwater samples collected at Site UXO-02.
- **Total Metals**

Table 4-5 indicates the total metals that exceeded screening criteria in samples collected from the area of Site UXO-02 outside the fenced perimeter of IR Site 69. **Table 4-6** indicates the total metals that exceeded screening criteria in samples collected from the area of Site UXO-02 inside and near the fenced perimeter of IR Site 69.

- **Dissolved Metals**

Table 4-7 indicates the dissolved metals that exceeded screening criteria in samples collected from the area of Site UXO-02 outside the fenced perimeter of IR Site 69.

Table 4-8 indicates the dissolved metals which exceeded screening criteria in samples collected from the area of Site UXO-02 inside and near the fenced perimeter of IR Site 69.

4.2.2 Surface Water and Sediment

This section presents the results for laboratory analysis of surface water and sediment samples. The detections and exceedances of the respective screening criteria are shown on the tables below. **Figures 4-5 and 4-6** depict the locations of samples that exceeded at least one of the screening criteria for metals.

Surface Water

Surface water samples were collected from 10 locations in accordance with the PA/SI Work Plan Addendum (CH2M HILL, 2009b). Laboratory analytical results were screened against NCAC 2B SW Human Health and Water Supply values (NC2B-SW), National Recommended Water Quality Criteria (NRWQC), and Adjusted Tap Water RSLs, from USEPA's Regional Screening Level Table. **Figure 4-5** depicts the locations of surface water samples that exceeded at least one of the screening criteria (i.e., NC2B-SW, NRWQC or USEPA Tap Water RSLs).

- **Explosives residues and perchlorate** were not detected in any of the surface water samples collected from Site UXO-02.
- **Total Metals**

Table 4-9 summarizes the frequency of exceedance of regulatory criteria for samples analyzed for total metals.

TABLE 4-9
Summary of Total Metals Exceedances in Surface Water

Summary of Total Metals Exceedance in Surface Water							
Chemical Name	Frequency of Detection (# detected / # analyzed)	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Location of Maximum Concentration	Screening Criteria (µg/L)		Frequency of Exceedance
Arsenic	6 / 11	1.3 J	3.1 J	MR02-SW05	NRWQC	0.018	6
Chromium	1 / 11	0.47 J	0.47 J	MR02-SW09	Tap Water RSL	0.043	1
Iron	9 / 11	125	2,140	MR02-SW09	NRWQC	300	7
Manganese	11 / 11	4.6 J	55.4	MR02-SW05	NRWQC	50	3

Notes:

µg/L - Micrograms per liter

J - Analyte present, value may or may not be accurate or precise

NRWQC - National Recommended Water Quality Criteria

RSL - Regional Screening Level

• Dissolved Metals

Table 4-10 summarizes the frequency of exceedance of regulatory criteria for samples analyzed for dissolved metals.

TABLE 4-10
Summary of Dissolved Metals Exceedances in Surface Water

Chemical Name	Frequency of Detection (# detected / # analyzed)	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Location of Maximum Concentration	Screening Criteria (µg/L)	Frequency of Exceedance	
Arsenic	4 / 11	1.3 J	3.2 J	MR02-SW02	Tap Water RSL	0.045	4
					NRWQC	0.018	4
Iron	9 / 11	101	1,420	MR02-SW09	NRWQC	300	3
Manganese	11 / 11	4.6 J	54.4	MR02-SW07	NRWQC	50	3

Sediment

Sediment samples were collected from 10 locations in accordance with the PA/SI Work Plan Addendum (CH2M HILL, 2009b). The laboratory analytical data were screened against the Adjusted USEPA Industrial and Residential RSLs for Chemical Contaminant Tables (USEPA, 2010a). **Figure 4-6** depicts the locations of sediment samples that exceeded at least one of the screening levels (USEPA Residential and Industrial RSLs).

- **Explosives residues** and **perchlorate** were not detected in any of the sediment samples collected from Site UXO-02.
- **Metals**

Table 4-11 summarizes the frequency of exceedance of regulatory criteria for samples analyzed for metals.

TABLE 4-11
Summary of Metals Exceedances in Sediment

Chemical Name	Frequency of Detection (# detected / # analyzed)	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Location of Maximum Concentration	Screening Criteria (mg/kg)	Frequency of Exceedance
Aluminum	11 / 11	2,400	31,400	MR02-SD01	Residential RSL 7,700	9
Arsenic	11 / 11	1 J	5.8	MR02-SD01	Residential RSL 0.39	11
					Industrial RSL 1.6	7
Chromium	8 / 11	3.4	39.7	MR02-SD01	Residential RSL 0.29	8
					Industrial RSL 5.6	7
Iron	11 / 11	1,220	16,800	MR02-SD01	Residential RSL 5,500	7
Vanadium	11 / 11	3.7 J	47.7	MR02-SD01	Residential RSL 39	1

TABLE 4-1

Summary of Metals Exceedances in Surface Soil
 Site UXO-02, Unnamed Explosive Contaminated Range
 PA/SI Report
 MCB CamLej
 North Carolina

Chemical Name	Frequency of Detection (# detected / # analyzed)	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Location of Maximum Concentration	Screening Criteria (mg/kg)		Frequency of Exceedances
Aluminum	202 / 202	212 J	13,600	MR02-SS12	2X Mean BBG	5,487	44
					Residential RSL	7,700	21
Antimony	14 / 202	0.1J	3.2 J	MR02-SS121	2X Mean BBG	0.447	1
					Residential RSL	3.1	1
Arsenic	165 / 202	0.16J	8.3J	MR02-SS24	NCSSL	5.8	1
					2X Mean BBG	0.626	68
					Residential RSL	0.39	105
					Industrial RSL	1.6	3
Barium	154 / 202	1.7J	93.2	MR02-SS05	2X Mean BBG	14.5	61
Beryllium	45 / 202	0.01 J	0.51J	MR02-SS05 MR02-SS07	2X Mean BBG	0.103	15
Cadmium	36 / 202	0.01 J	0.13 J	MR02-SS176	2X Mean BBG	0.033	6
Chromium	142 / 202	0.34 J	12.9	MR02-SS24	NCSSL	3.8	41
					2X Mean BBG	6.05	15
					Residential RSL	0.29	142
					Industrial RSL	5.6	19
Cobalt	139 / 202	0.03 J	2 J	MR02-SS92	2X Mean BBG	0.294	48
Copper	4 / 202	4.8	7.8	MR02-SS183	2X Mean BBG	4.83	3
Iron	202 / 202	141	20,800	MR02-SS24	NCSSL	150	201
					2X Mean BBG	3,245	13
					Residential RSL	5,500	4
Lead	202 / 202	2.2	27.6	MR02-SS171	2X Mean BBG	12.3	17
Manganese	202 / 202	4.9	594	MR02-SS149	NCSSL	65	33
					2X Mean BBG	13.7	170
					Residential RSL	180	4
Mercury	176 / 202	0.01 J	0.14 J	MR02-SS171	2X Mean BBG	0.081	6
Nickel	85 / 202	0.19J	9.3	MR02-SS24	2X Mean BBG	1.21	24
Potassium	25 / 202	32.3J	479 J	MR02-SS01	2X Mean BBG	116	20
Selenium	117 / 202	0.1 J	0.57 J	MR02-SS12	2X Mean BBG	0.563	1
Sodium	20 / 202	6.6 J	168 J	MR02-SS81D	2X Mean BBG	80.9	7
Vanadium	154 / 202	0.48 J	18.1	MR02-SS07	2X Mean BBG	8.9	13
Zinc	150 / 202	1.4 J	53.3	MR02-SS14	2X Mean BBG	10.8	40

Notes:

mg/kg = Milligramms per kilogram

J = Analyte present, value may or may not be accurate or precise

BBG= Base Background

RSL= Regional Screening Level

NCSSL= North Carolina Soil Screening Level

Prepared by: Betsy Reid Checked by: Verd Anna Cunningham

TABLE 4-2

Summary of Metals Exceedances in Site 69 Surface Soil
 Site UXO-02, Unnamed Explosive Contaminated Range
 PA/SI Report
 MCB CamLej
 North Carolina

Chemical Name	Frequency of Detection (# detected / # analyzed)	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Location of Maximum Concentration	Screening Criteria (mg/kg)		Frequency of Exceedances
Arsenic	24 / 24	0.24 J	1.6	MR02-IR69-SS15	2x mean BBG	0.626	2
					Residential RSL	0.39	20
Barium	8 / 24	5 J	30.8 J	MR02-IR69-SS01	2x mean BBG	14.5	3
Calcium	1 / 24	39,700	39,700	MR02-IR69-SS15	2x mean BBG	6,360	1
Chromium	19 / 24	0.99 J	12	MR02-IR69-SS15	NCSSL	3.8	2
					2x mean BBG	6.05	1
					Residential RSL	0.29	19
					Industrial RSL	5.6	1
Copper	9 / 24	1.2 J	5.6 J	MR02-IR69-SS15	2x mean BBG	4.83	1
Iron	24 / 24	469	4,530	MR02-IR69-SS15	NCSSL	150	24
					2x mean BBG	3,245	1
Lead	24 / 24	2.2	221	MR02-IR69-SS17	2x mean BBG	12.3	1
Manganese	24 / 24	5.9	141	MR02-IR69-SS15	NCSSL	65	1
					2x mean BBG	13.7	15
Potassium	24 / 24	43 J	591 J	MR02-IR69-SS15	2x mean BBG	116	8
Vanadium	9 / 24	2.1 J	16.9	MR02-IR69-SS15	2x mean BBG	8.9	1
Zinc	12 / 24	4.3	31.2	MR02-IR69-SS12	2x mean BBG	10.8	5

Notes:

mg/kg = Milligramms per kilogram

J = Analyte present, value may or may not be accurate or precise

BBG= Base Background

RSL= Regional Screening Level

NCSSL= North Carolina Soil Screening Level

Prepared by: Betsy Reid Checked by: Verd Anna Cunningham

TABLE 4-3

Summary of Metals Exceedances in Subsurface Soil
 Site UXO-02, Unnamed Explosive Contaminated Range
 PA/SI Report
 MCB CamLej
 North Carolina

Chemical Name	Frequency of Detection (# detected / # analyzed)	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Location of Maximum Concentration	Screening Criteria (mg/kg)		Frequency of Exceedances
Aluminum	30 / 30	39.3	2400	MR02-IS02-5-6	2X Mean BBG	10,369	10
					Residential RSL	7,700	11
Arsenic	18 / 30	0.12 J	5.5	MR02-IS02-5-6 MR02-IS17-5-6	2X Mean BBG	2.12	7
					Industrial RSL	1.6	9
					Residential RSL	0.39	12
Barium	25 / 30	1.4 J	30.2 J	MR02-IS08-4-5	2X Mean BBG	16.6	9
Cadmium	1 / 30	0.08 J	0.08 J	MR02-IS17-5-6	2X Mean BBG	0.023	1
Chromium	21 / 30	2	35	MR02-IS17-5-6	2X Mean BBG	14.5	8
					NC SSL	3.8	14
					Industrial RSL	5.6	12
					Residential RSL	0.29	21
Cobalt	11 / 30	0.04 J	1.3 J	MR02-IS17-5-6	2X Mean BBG	0.822	1
Copper	2 / 30	5.7	6.3	MR02-IS17-5-6	2X Mean BBG	2.56	2
Iron	30 / 30	51.7	17,900 J	MR02-IS17-5-6	2X Mean BBG	5,439	9
					NC SSL	150	29
					Residential RSL	5,500	8
Lead	30 / 30	0.3 J	9.6	MR02-IS17-5-6	2X Mean BBG	8.49	1
Magnesium	4 / 30	940 J	1,330 J	MR02-IS01-6-7	2X Mean BBG	363	4
Manganese	29 / 30	2.4 J	29	MR02-IS21D-5-6	2X Mean BBG	9.25	13
Nickel	11 / 30	0.11 J	4 J	MR02-IS17-5-6	2X Mean BBG	2.27	2
Potassium	18 / 30	38.7 J	1,610 J	MR02-IS17-5-6	2X Mean BBG	361	9
Selenium	21 / 30	0.05 J	0.55 J	MR02-IS17-5-6	2X Mean BBG	0.505	2
Vanadium	14 / 30	0.21 J	46.4	MR02-IS17-5-6	2X Mean BBG	17.2	9
					Residential RSL	39	1
Zinc	10 / 30	3.7	23.6	MR02-IS17-5-6	2X Mean BBG	6.59	9

Notes:

mg/kg = Milligramms per kilogram

J = Analyte present, value may or may not be accurate or precise

BBG= Base Background

RSL= Regional Screening Level

NCSSL= North Carolina Soil Screening Level

Prepared by: Verd Anna Cunningham Checked by: Rachel Zajac

TABLE 4-4

Summary of Metals Exceedances in Site 69 Subsurface Soil
 Site UXO-02, Unnamed Explosive Contaminated Range
 PA/SI Report
 MCB CamLej
 North Carolina

Chemical Name	Frequency of Detection (# detected / # analyzed)	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Location of Maximum Concentration	Screening Criteria (mg/kg)		Frequency of Exceedances
Arsenic	4 / 4	0.21 J	0.91	MR02-IR69-IS03-7_5-9_5	Residential RSL	0.39	3
Chromium	3 / 4	6.3	6.6	MR02-IR69-IS01D-5-6	NC SSL	3.8	3
					Industrial RSL	5.6	3
					Residential RSL	0.29	3
Iron	4 / 4	645	2,470	MR02-IR69-IS03-7_5-9_5	NC SSL	150	4
Manganese	4 / 4	5.6	12.9	MR02-IR69-IS01D-5-6	2X Mean BBG	9.25	3
Zinc	2 / 4	1.2 J	16.8	MR02-IR69-IS03-7_5-9_5	2X Mean BBG	6.59	1

Notes:

mg/kg = Milligramms per kilogram

J = Analyte present, value may or may not be accurate or precise

BBG= Base Background

RSL= Regional Screening Level

NCSSL= North Carolina Soil Screening Level

Prepared by: Verd Anna Cunningham Checked by: Rachel Zajac

TABLE 4-5

Summary of Total Metals Exceedances in Groundwater
 Site UXO-02, Unnamed Explosive Contaminated Range
 PA/SI Report
 MCB CamLej
 North Carolina

Chemical Name	Frequency of Detection (# detections / # analyzed)	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Location of Maximum Concentration	Screening Criteria (µg/L)		Frequency of Exceedances
Aluminum	30 / 31	64.6 J	55,400 J	MR02-TW17	2X Mean BBG	1,886	14
					Tap Water RSL	3,700	12
Antimony	2 / 31	2 J	7 J	MR02-TW08	2X Mean BBG	3.28	1
					Tap Water RSL	1.5	2
					NC2LGW	6	1
Arsenic	6 / 31	2 J	9.3 J	MR02-TW12	2X Mean BBG	5.8	2
					Tap Water RSL	0.045	6
Barium	29 / 31	8.5 J	214	MR02-TW06	2X Mean BBG	86.2	4
Chromium	7 / 31	10.6	56.8	MR02-TW17	2X Mean BBG	3.13	7
					Tap Water RSL	0.043	7
					NC2LGW	10	7
Cobalt	8 / 31	0.87 J	10 J	MR02-TW12	2X Mean BBG	3.4	1
					Tap Water RSL	1.1	7
Copper	3 / 31	26.2	48.4	MR02-TW06	2X Mean BBG	2.76	3
Iron	30 / 31	113 J	20,700	MR02-TW12	2X Mean BBG	5,999	5
					Tap Water RSL	2,600	9
					NC2LGW	300	28
Lead	20 / 31	0.81 J	24.1	MR02-TW06	2X Mean BBG	2.8	12
					Tap Water RSL	15	3
					NC2LGW	15	3
Magnesium	2 / 31	7,650	8,410 J	MR02-TW09	2X Mean BBG	6,363	2
Manganese	26 / 31	17.1	245	MR02-TW12	2X Mean BBG	214	1
					Tap Water RSL	88	6
					NC2LGW	50	14
Nickel	30 / 31	0.46 J	24.5 J	MR02-TW25	2X Mean BBG	7.97	8
Potassium	31 / 31	280 J	9,040	MR02-TW08	2X Mean BBG	3,277	3
Sodium	28 / 31	5,300	75,000	MR02-TW09	2X Mean BBG	22,508	6
Vanadium	24 / 31	0.5 J	54.5	MR02-TW17	2X Mean BBG	5	9
					Tap Water RSL	18	4
Zinc	15 / 31	27.7	424	MR02-TW16	2X Mean BBG	42.1	11

Notes:

µg/L = Micrograms per liter

J = Analyte present, value may or may not be accurate or precise

BBG= Base Background

RSL= Regional Screening Level

NC2LGW= North Carolina 2L Groundwater Quality Standards

Prepared by: Verd Anna Cunningham Checked by: Rachel Zajac

TABLE 4-6

Summary of Total Metals Exceedances in Site 69 Groundwater
 Site UXO-02, Unnamed Explosive Contaminated Range
 PA/SI Report
 MCB CamLej
 North Carolina

Chemical Name	Frequency of Detection (# detections / # analyzed)	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Location of Maximum Concentration	Screening Criteria (µg/L)		Frequency of Exceedances
Arsenic	2 / 8	2.4 J	5.6 J	MR02-IR69-MW15	Tap Water RSL	0.045	2
Chromium	5 / 8	0.62 J	1.9 J	MR02-IR69-MW09	Tap Water RSL	0.043	5
Cobalt	4 / 8	0.29 J	2 J	MR02-IR69-MW09	Tap Water RSL	1.1	1
Copper	1 / 8	5.7 J	5.7 J	MR02-IR69-MW09	2X Mean BBG	2.76	1
Iron	8 / 8	86.6 J	30,800	MR02-IR69-MW15	2X Mean BBG	5,999	1
					Tap Water RSL	2,600	2
					NC2LGW	300	4
Manganese	8 / 8	5 J	802	MR02-IR69-MW15	2X Mean BBG	214	1
					Tap Water RSL	88	1
					NC2LGW	50	1
Sodium	6 / 8	6,360	24,100	MR02-IR69-MW15	2X Mean BBG	22,508	1
Zinc	1 / 8	63.5	63.5	MR02-IR69-MW12	2X Mean BBG	42.1	1

Notes:

µg/L = Micrograms per liter

J = Analyte present, value may or may not be accurate or precise

BBG= Base Background

RSL= Regional Screening Level

NC2LGW= North Carolina 2L Groundwater Quality Standards

Prepared by: Verd Anna Cunningham Checked by: Rachel Zajac

TABLE 4-7

Summary of Dissolved Metals Exceedances in Groundwater
 Site UXO-02, Unnamed Explosive Contaminated Range
 PA/SI Report
 MCB CamLej
 North Carolina

Chemical Name	Frequency of Detection (# detections / # analyzed)	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Location of Maximum Concentration	Screening Criteria (µg/L)		Frequency of Exceedances
Aluminum	13 / 13	19 J	1,960	MR02-TW10	2X Mean BBG	1,886	1
Antimony	1 / 13	1.9 J	1.9 J	MR02-TW29	Tap Water RSL	1.5	1
Arsenic	1 / 13	4 J	4 J	MR02-TW12	Tap Water RSL	0.045	1
Cobalt	5 / 13	0.85 J	8.6 J	MR02-TW12	2X Mean BBG	3.4	1
					Tap Water RSL	1.1	1
Iron	11 / 13	34.2 J	11,400	MR02-TW12	2X Mean BBG	5,999	1
					Tap Water RSL	2,600	2
					NC2LGW	300	9
Lead	4 / 13	0.8 J	3.4	MR02-TW22	2X Mean BBG	2.8	1
Magnesium	1 / 13	7,190	7,190	MR02-TW12	2X Mean BBG	6,363	1
Manganese	9 / 13	15.7	209	MR02-TW12	Tap Water RSL	88	3
					NC2LGW	50	7
Nickel	13 / 13	1.1 J	26.8 J	MR02-TW25	2X Mean BBG	7.97	4
Potassium	13 / 13	428 J	7,390	MR02-TW08	2X Mean BBG	3,277	1
Selenium	8 / 13	0.64	5 J	MR02-TW26	2X Mean BBG	3.14	1
Sodium	12 / 13	5,560	39,400	MR02-TW12	2X Mean BBG	22,508	2
Vanadium	4 / 13	0.95 J	6.4 J	MR02-TW12	2X Mean BBG	4.72	2
Zinc	9 / 13	22.9	332	MR02-TW25	2X Mean BBG	42.1	6

Notes:

µg/L = Micrograms per liter

J = Analyte present, value may or may not be accurate or precise

BBG= Base Background

RSL= Regional Screening Level

NC2LGW= North Carolina 2L Groundwater Quality Standards

Prepared by: Verd Anna Cunningham Checked by: Rachel Zajac

TABLE 4-8

Summary of Dissolved Metals Exceedances in Site 69 Groundwater

Site UXO-02, Unnamed Explosive Contaminated Range

PA/SI Report

MCB CamLej

North Carolina

Chemical Name	Frequency of Detection (# detections / # analyzed)	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Location of Maximum Concentration	Screening Criteria (µg/L)		Frequency of Exceedances
Chromium	5 / 8	0.44 J	1.4 J	MR02-IR69-MW15	Tap Water RSL	0.043	5
Cobalt	2 / 8	0.55 J	1.6 J	MR02-IR69-MW09	Tap Water RSL	1.1	1
Iron	5 / 8	38.4 J	27,800	MR02-IR69-MW15	2X Mean BBG	5,999	1
					Tap Water RSL	2,600	2
					NC2LGW	300	3
Manganese	8 / 8	4.4 J	763	MR02-IR69-MW15	2X Mean BBG	214	1
					Tap Water RSL	88	1
					NC2LGW	50	1
Sodium	6 / 8	6,380	23,000	MR02-IR69-MW15	2X Mean BBG	22,508	1
Zinc	4 / 8	4.9 J	87.5	MR02-IR69-MW12	2X Mean BBG	42.1	1

Notes:

µg/L = Micrograms per liter

J = Analyte present, value may or may not be accurate or precise

BBG= Base Background

RSL= Regional Screening Level

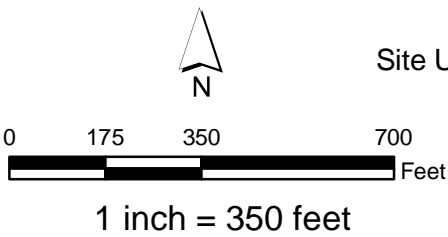
NC2LGW= North Carolina 2L Groundwater Quality Standards

Prepared by: Verd Anna Cunningham Checked by: Rachel Zajac



Legend

- Geophysical Anomaly
- Approximate DGM Transect
- UXO-02 Sampling Areas
- Site UXO-02
- Site 69



Site UXO-02 Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Figure 4-1
DGM Results
PA/SI Report
MCB CamLej
North Carolina





Legend

Site UXO-02

Site 69

Exceedances

- 2X Mean BBG + NCSSL
- 2X Mean BBG + Adjusted Industrial Soil RSL
- 2X Mean BBG + Adjusted Residential Soil RSL

0 175 350 700 Feet

1 inch = 350 feet

Figure 4-2
Metal Exceedances in Surface Soil
Site UXO-02 Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina



Aerial Photography date 2009



Legend

- Site UXO-02
- Site 69

Metal Exceedances

- 2X Mean BBG + NCSSL
- 2X Mean BBG + Adjusted Industrial Soil RSL
- 2X Mean BBG + Adjusted Residential Soil RSL

Aerial Photography date 2009

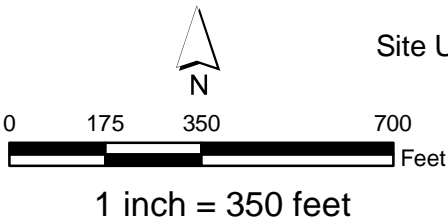


Figure 4-3
Metal Exceedances in Subsurface Soil
Site UXO-02 Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina





Legend
Site UXO-02
Site 69
Exceedances
2X Mean BBG + NC2LGW
2X Mean BBG + Adjusted Tap Water RSL

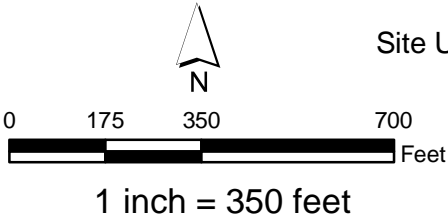


Figure 4-4
Metal Exceedances in Groundwater
Site UXO-02 Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina





Legend
Site UXO-02
Site 69
Exceedances
NRWQC
Adjusted Tap Water RSLs

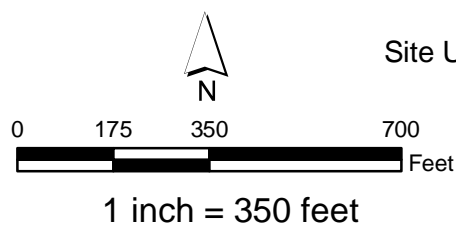


Figure 4-5
Metal Exceedances in Surface Water
Site UXO-02 Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina





- Legend**
- Site UXO-02
 - Site 69
 - Exceedances**
 - Adjusted Industrial Soil RSL
 - Adjusted Residential Soil RSL



Figure 4-6
Metal Exceedances in Sediment
Site UXO-02 Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina



Human Health Risk Screening

5.1 Human Health Risk Screening Overview

A conservative preliminary human health risk screening was performed to assess the potential for human health risks associated with exposure to site media (soil, sediment, surface water, and groundwater). The results of the human health risk screening provide a preliminary indication of potential risks from constituents of potential concern (COPCs), and are used to help evaluate whether future residential use of the site is acceptable based on human health risks or if the site requires further evaluation (e.g., a baseline risk assessment, additional data collection).

The human health risk screening was conducted in three steps using a risk ratio technique (Department of the Navy, 2000) described below.

5.1.1 Step 1

The maximum detected analyte concentrations for each medium were compared to human health RSLs (USEPA, 2010a), one or more other human health risk screening levels (if appropriate), and two times the mean background concentration (for inorganic constituents in soil and groundwater). RSLs based on noncarcinogenic effects were divided by 10 to account for exposure to multiple analytes (i.e., were adjusted to a hazard quotient [HQ] of 0.1, from the HQ of 1.0 used on the RSL table). RSLs based on carcinogenic endpoints were used as presented in the RSL table, and are based on a carcinogenic risk of 1×10^{-6} .

The soil and sediment data were compared to residential soil RSLs. Residential RSLs are more conservative (i.e., lower) than industrial soil RSLs and are therefore protective of all potential receptors (e.g., residents, industrial workers, construction workers). NC SSLs are also shown on the Step 1 screening tables for comparison, but were not used to identify COPCs for further evaluation in the following steps. The groundwater data were compared to adjusted (for noncarcinogens) Tap Water RSLs. Groundwater data were also compared to maximum contaminant levels (MCLs) and the NC 2L Standards; however, these comparisons were not used to identify the groundwater COPCs to carry forward to Step 2.

The surface water data were compared to the lower of the NCAC 2B water quality standards for human health and water supply (if available), or the NRWQC for human health (water and organisms criteria). If neither of these were available for a detected constituent, the adjusted Tap Water RSL was used for comparison and identification of COPCs.

If the maximum detected concentration in soil, groundwater, surface water, or sediment exceeded the appropriate screening value and background concentration, the screening level risk evaluation proceeded to Step 2. In addition, if a carcinogenic polycyclic aromatic hydrocarbon (cPAH), such as benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene, was

selected as a COPC, all detected cPAHs were carried over to Step 2 based on the selection criterion of a chemical from the same class, cPAH.

In addition to comparing the detected concentrations to the screening levels, the detection limits for non-detected analytes were compared to the screening levels. Non-detected analytes with detection limits exceeding the screening level were not identified as COPCs to carry forward to Step 2, but are discussed below to evaluate the potential for underestimating the total risks.

5.1.2 Step 2

For analytes identified as COPCs in Step 1, a corresponding risk level was calculated using the following equation:

$$\text{corresponding risk level} = \frac{\text{concentration} \times \text{acceptable risk level}}{\text{RSL}}$$

The concentration is the maximum detected concentration (the same that was used in Step 1). The acceptable risk level is 1 for noncarcinogens and 1×10^{-6} for carcinogens. RSLs for noncarcinogenic effects were not adjusted by 10 as was done in Step 1; rather, they were used as presented in the RSL table.

All of the corresponding risk levels for each analyte within a medium were summed to calculate the cumulative corresponding hazard index (HI) (for noncarcinogens) and cumulative corresponding carcinogenic risk (for carcinogens). A cumulative corresponding HI was also calculated for each target organ/effect. If the cumulative corresponding HI for a target organ/effect was greater than 0.5, or the cumulative corresponding carcinogenic risk was greater than 5×10^{-5} , the analytes contributing to these values were retained as COPCs and carried forward to Step 3.

5.1.3 Step 3

A corresponding risk level was calculated as discussed above for Step 2; however, the 95% upper confidence limit (UCL) was used in place of the maximum detected concentration, if more than five samples were available for that medium, to obtain a more site-specific risk ratio. If the cumulative corresponding HI by target organ/effect was greater than 0.5, or the cumulative corresponding carcinogenic risk was greater than 5×10^{-5} , then analytes contributing to these values were considered COPCs.

ProUCL Version 4.00.05 (USEPA, 2010b), was used to test the data distribution and calculate 95% percent UCL exposure point concentrations (EPCs) used for the Step 3 risk ratio calculations. Whenever the recommended UCL exceeded the maximum detected concentration, the maximum concentration was used as the EPC.

Vapor intrusion from groundwater (or soil) to indoor air was not evaluated for Site UXO-02. The primary objective of the Site UXO-02 investigation was to evaluate the potential presence and nature of impacts to environmental media resulting from historical munitions use at the site. VOCs are not associated with the use of UXO-02 as an explosives range.

5.2 Human Health Risk Screening Results

5.2.1 Surface Soil

Tables 2.1 through 2.1b in **Appendix G** present the risk-based screening and risk ratio evaluation for surface soil. As shown on Table 2.1 in **Appendix G**, one explosives residue, (nitroglycerin), and six metals (aluminum, antimony, arsenic, chromium, iron, and manganese) were identified as COPCs. Based on Step 2 (risk ratio using maximum detected concentrations, Table 2.1a, **Appendix G**), arsenic and chromium were retained as COPCs and carried forward to Step 3 (Table 2.1b, **Appendix G**), where the 95% UCL concentration resulted in a cumulative carcinogenic risk below the screening criteria. Therefore, future exposure to surface soil at Site UXO-02 is not expected to result in unacceptable human health risks.

5.2.2 Surface Water

Tables 2.2 through 2.2b, **Appendix G**, present the risk-based screening for surface water. As shown on Table 2.2, **Appendix G**, three metals (arsenic, iron, and manganese) exceeded the first step of the screening and were identified as COPCs for evaluation in Step 2. In Step 2 of the surface water screening (Table 2.2a, **Appendix G**), the Tap Water RSLs (USEPA, 2010a) were used as the screening values, even if NC 2L Standards and/or Federal Ambient Water Quality Criteria were available, as these screening values are not necessarily risk-based. Based on Step 2 (risk ratio using maximum detected concentrations), arsenic was retained as a COPC and carried forward to Step 3 (Table 2.2b, **Appendix G**), where the 95% UCL concentration resulted in a cumulative carcinogenic risk equal to the screening criteria. Therefore, exposure to surface water at Site UXO-02 is not expected to result in unacceptable human health risks.

5.2.3 Sediment

Tables 2.3 through 2.3b, **Appendix G**, present the risk-based screening and risk ratio evaluation for sediment. As shown on Table 2.3, **Appendix G**, five metals (aluminum, arsenic, chromium, iron, and vanadium) exceeded the first step of the screening and were identified as COPCs for evaluation in Step 2. Based on Step 2 (risk ratio using maximum detected concentrations, Table 2.3a, **Appendix G**), arsenic and chromium were retained as COPCs and carried forward to Step 3 (Table 2.3b, **Appendix G**), where the 95% UCL concentration resulted in a cumulative carcinogenic risk above the screening criteria.

Chromium is the main contributor to the carcinogenic risk associated with the sediment. The analytical data for chromium are for total chromium; however, the RSL used for the screening is for hexavalent chromium, the more toxic (and carcinogenic) valence state. In the past, prior to including the New Jersey EPA oral cancer slope factor for hexavalent chromium in the table, USEPA's RSL table presented a residential soil RSL for total chromium assuming a 1 to 6 ratio of hexavalent chromium to trivalent chromium. Assuming this ratio applies for sediment at Site UXO-02, the 95% UCL concentration of hexavalent chromium (the 95% UCL concentration presented on Table 2.3b multiplied by 1/6) would not result in an unacceptable risk associated with exposure to the chromium. It should also be noted that there is some uncertainty associated with the hexavalent chromium oral cancer slope factor, and RSL, as the value is from the New Jersey EPA and has not been included in USEPA's Integrated Risk Information System (IRIS) database.

Elimination of chromium as a COPC in sediment would also result in elimination of arsenic as a COPC in Step 3, as it does not contribute significantly (above 5×10^{-5}) to the cumulative calculated risk.

Although exposure to sediment could potentially result in risks above acceptable levels, it should be noted that residential soil screening levels were conservatively used to screen the sediment data, and exposure to sediment would be much less than the exposure assumed for soil. Therefore, no further evaluation of the sediment was performed, and it is assumed there would be no unacceptable risks associated with exposure to the sediment by potential trespassers/visitors, industrial workers, or construction workers.

Therefore, exposure to sediment would not result in unacceptable risk to human receptors and further evaluation of potential human health risks related to sediment is not necessary.

5.2.4 Groundwater

The risk-based screening and risk ratio evaluation for groundwater are presented in Tables 2.4 through 2.4b of **Appendix H**. As shown on Table 2.4, **Appendix H**, nine metals (aluminum, antimony, arsenic, chromium, cobalt, iron, lead, manganese, and vanadium) exceeded the first step of the screening and were identified as COPCs for evaluation in Step 2. Lead was evaluated separately, as discussed below. Based on Step 2 (risk ratio using maximum detected concentrations, Table 2.4a, **Appendix H**), all of the Step 1 COPCs were carried forward to Step 3. Based on Step 3 (risk ratio using arithmetic average in groundwater (Table 2.4b, **Appendix H**), arsenic, chromium, and cobalt were retained as COPCs. All of the groundwater data collected from the monitoring wells in February and March 2010 were used to estimate the groundwater concentration for the Step 3 evaluation. A groundwater plume has not been identified, and no specific "hot spots" or more contaminated wells were identified. Therefore, using all of the data to calculate the arithmetic average groundwater concentration was considered appropriate.

The use of hexavalent chromium for comparison to total chromium is extremely conservative since the presence of trivalent chromium is strongly favored in natural waters because the concentrations of constituents known to reduce hexavalent chromium to trivalent chromium generally far outweigh the concentrations of the few constituents known to oxidize trivalent chromium to hexavalent chromium. Furthermore, once reduced, trivalent chromium is very stable in aquatic environments and highly unlikely to oxidize to hexavalent chromium. Thus, chromium in groundwater is more likely to be in its trivalent form than its hexavalent form (Fendorf and Zasoski, 1992; Milacic and Stupar, 1995; Weaver and Hochella, 2003)."

Lead, which was retained as a COPC for groundwater in Step 1, does not have available published toxicity factors. Lead is regulated by USEPA based on blood-lead uptake using a physiologically based pharmacokinetic model called the Integrated Exposure Uptake Biokinetic (IEUBK) model. The maximum detected concentration of lead in the groundwater of 24.1 $\mu\text{g}/\text{L}$ exceeded the groundwater screening level. Risks associated with lead in the groundwater were evaluated for the resident using USEPA's IEUBK model. The principal assumption associated with the use of IEUBK is that a child from age 0 to 7 is the receptor for potential exposure to lead. The average lead concentration is used as the EPC in the IEUBK model.

The results of the IEUBK model for groundwater are shown in Table 2.4c, **Appendix G**. The IEUBK evaluation resulted in a geometric mean blood concentration of 2.9 micrograms per deciliter of blood ($\mu\text{g}/\text{dL}$) for children 0 to 7 years old. Less than 1 percent of this population had a blood lead level above USEPA's recommended level of 10 $\mu\text{g}/\text{dL}$. USEPA considers lead not to be a health concern if 95 percent of the population has a blood lead level less than 10 $\mu\text{g}/\text{dL}$. Therefore, lead in groundwater does not pose a health risk under residential use of the site. Since residential exposures are the most conservative, risks for any other potential receptor (i.e., construction worker) would be less than residential risks. With the exception of the mean lead groundwater concentration, the default parameters associated with the IEUBK model were used in this evaluation (as shown in Table 2.4c, **Appendix G**).

5.2.5 Subsurface Soil

Tables 2.5 through 2.5b in **Appendix G** present the risk-based screening and risk ratio evaluation for subsurface soil. As shown on Table 2.5 in **Appendix G**, five metals (aluminum, arsenic, chromium, iron, and vanadium) were identified as COPCs. Based on Step 2 (risk ratio using maximum detected concentrations, Table 2.5a, **Appendix G**), arsenic and chromium were retained as COPCs and carried forward to Step 3 (Table 2.5b, **Appendix G**), where the 95% UCL concentration resulted in a cumulative carcinogenic risk above the screening criteria.

Chromium is the main contributor to the carcinogenic risk associated with the subsurface soil. The analytical data for chromium are for total chromium; however, the RSL used for the screening is for hexavalent chromium, the more toxic (and carcinogenic) valence state. In the past, prior to including the New Jersey EPA oral cancer slope factor for hexavalent chromium in the table, USEPA's RSL table presented a residential soil RSL for total chromium assuming a 1 to 6 ratio of hexavalent chromium to trivalent chromium. Assuming this ratio applies for subsurface soil at Site UXO-02, the maximum concentration of hexavalent chromium (the total measured chromium concentration multiplied by 1/6) would not result in an unacceptable risk associated with exposure to the chromium. It should also be noted that there is some uncertainty associated with the hexavalent chromium oral cancer slope factor, and RSL, as the value is from the New Jersey EPA and has not been included in USEPA's Integrated Risk Information System (IRIS) database. Elimination of chromium as a COPC in subsurface soil would also result in elimination of arsenic as a COPC in Step 3, as it does not contribute significantly (above 5×10^{-5}) to the cumulative calculated risk.

Therefore, exposure to subsurface soil would not result in unacceptable risk to human receptors and further evaluation of potential human health risks related to subsurface soil is not necessary.

5.3 Conclusion

The preliminary human health risk-based screening indicates the potential for risks associated with exposure to aluminum, antimony, arsenic, chromium, iron, manganese, and vanadium in groundwater.

Exposure to surface soil, surface water, sediment, and subsurface soil within Site UXO-02 is not expected to result in unacceptable human health risks, and further investigation of these media is unnecessary.

Ecological Risk Screening

An ecological risk screen (ERS) was conducted for Site UXO-02.

6.1 Introduction

The field investigation of Site UXO-02 included the collection and laboratory analysis of soil, sediment, surface water, and groundwater samples. The laboratory analytical results were subsequently screened against benchmarks intended to be protective of ecological receptors.

6.1.1 Site Ecological Setting and Available Data

The vast majority of Site UXO-02 is wooded, with some areas supporting dense undergrowth and other areas with a high percent canopy closure and sparse understory. Along the eastern boundary of the site, wet, saturated areas drain into the New River. Topography is generally flat, with the exception of the drainage ravines. Within the fenced perimeter of IR Site 69, the terrain is hummocky due to historical excavation activities associated with the chemical dump. Groundwater flow in the area is to the east and northeast toward the New River. The ecological checklist in **Appendix H** identifies the terrestrial and aquatic habitats onsite or nearby.

A total of 205 surface soil samples (and 21 duplicates) from 0 to 2 inches bgs, 31 subsurface samples (and 3 duplicates) from 0 to 5 ft bgs, 10 sediment samples (and 1 duplicate) from 0 to 6 inches bgs, 10 surface water samples (and 1 duplicate), and 35 groundwater samples (and 4 duplicates) were collected across the site and used in the ERS. All samples were analyzed for metals and explosives. Dissolved concentrations of inorganic analytes in groundwater and surface water were also available.

6.1.2 Screening Methodology

For each medium (surface soil, subsurface soil, sediment, surface water, and groundwater), the maximum and arithmetic mean concentrations were calculated and all ecological screening values (ESVs) intended to be protective of ecological receptors were identified. HQs were calculated by dividing these statistics by the ESVs. It should be noted that ESVs for inorganic constituents in water are generally based on dissolved concentrations and comparing them to total metals concentrations is conservative and may over-represent risk.

For soil, the USEPA ecological soil screening levels (EcoSSLs) (USEPA, 2009b) were preferentially selected over USEPA Region 4 values (USEPA, 2001). When no EcoSSL was available for a constituent, the USEPA Region 4 value was selected.

A selection hierarchy was also applied to surface water. The NRWQC were preferentially selected over the USEPA Region 4 values (USEPA, 2009a). However, when no NRWQC was available for a constituent, the USEPA Region 4 value was selected as the ESV for that constituent. Because groundwater and surface water discharge to unnamed tributaries to the north or the New River to the east, groundwater and surface water data were screened against marine ESVs. For sediment, USEPA Region 4 values were used. When an ESV value

was not available for a detected analyte, a supplemental screening value from published literature was used, as available.

A Base background study was conducted at MCB CamLej in June and July 2000 (Baker, 2001) and data from this study were used to evaluate inorganic concentrations in soil and groundwater at the site. As part of the ERS, surface soil and groundwater background concentrations (2 times the mean) were compared to site-specific media concentrations (maximum concentrations). Additional lines of evidence in the evaluation included the frequency of detection, frequency of exceedance, magnitude of exceedance, and identification of potential laboratory contaminants.

6.2 Screening Results

This section addresses constituents that were detected and had available ESVs based on the selection hierarchy discussed above. Constituents that were not detected are not expected to pose a risk to ecological receptors. Tables 1 through 5 of **Appendix H** present the screening results for surface soil, subsurface soil, sediment, surface water, and groundwater, respectively.

6.2.1 Surface Soil

Of the analytes detected in surface soil with available ESVs or supplemental screening values, nine inorganic constituents were calculated to have maximum-based HQs greater than 1.0. Aluminum and vanadium had HQs greater than 1.0, but were both found to occur within the range of background values. Manganese, mercury, selenium, and zinc all had low magnitudes of exceedance, with maximum-based HQs of less than 3 and low frequencies of exceedance (4 or less out of 205 for each constituent). While antimony had a maximum-based HQ greater than 1.0, the exceedance frequency was low (1.5 percent). Additionally, iron and lead both had elevated HQs; however, only 1 of 205 samples for each analyte contained concentrations greater than the maximum background concentrations, suggesting that these analytes are generally within the background range across the site. Consequently, analytes in surface soils are not expected to pose risk to ecological receptors.

6.2.2 Subsurface Soil

Aluminum, iron, and vanadium all had HQs greater than 1.0. For aluminum, only 1 of 19 sample concentrations exceeded the maximum background concentration, suggesting that detected concentrations are generally within the background range. For iron and vanadium, all concentrations were within the background range (maximum detected less than maximum background concentration). In addition, the analytes were not identified as posing a risk in surface soils. Consequently, analytes in subsurface soils are not expected to pose risk to ecological receptors.

6.2.3 Sediment

None of the analytes detected in sediment, with available ESVs or supplemental screening values, had maximum-based HQs greater than 1.0. Consequently, the detected target analytes in sediment are not expected to pose risk to ecological receptors.

6.2.4 Surface Water

Of the target analytes with available ESVs or supplemental screening values, aluminum (total), iron (total and dissolved), and copper (dissolved) were the only analytes with a maximum-based HQ greater than 1.0. While total aluminum had a maximum-based HQ greater than 1.0, the HQ based on dissolved concentrations was less than 1.0. Although iron had HQs greater than 1.0 for both total and dissolved concentrations, the magnitudes of exceedance were low, with HQs of 2.1 and 1.4, respectively. The supplemental screening value is based on freshwater, and freshwater was collected at the site. For copper, the magnitude of exceedance was low (HQ = 1.03) and only 1 of 10 concentrations exceeded the ESV. Consequently, risk from inorganic constituents is considered negligible and target analytes detected in surface water are not expected to pose risk to ecological receptors.

6.2.5 Groundwater

Aluminum (total), chromium (total), copper (total), lead (total), nickel (total and dissolved), iron (total), manganese (total and dissolved), vanadium (total), and zinc (total and dissolved) all had maximum-based HQs greater than 1.0. Of these, dissolved aluminum and iron concentrations were within the background range. Chromium, copper, and lead were either not detected in samples analyzed for dissolved metals or detected at concentrations lower than respective ESVs. As a result, they are not expected to pose risk to ecological receptors.

While nickel and zinc had maximum-based HQs greater than 1.0 based on both total and dissolved analyses, the magnitudes of exceedance for nickel were low (HQs less than 3.5) and only 2 dissolved concentrations out of 20 were greater than the background range for each analyte. The latter suggests that concentrations in groundwater are generally consistent with background. Additionally, the mean HQ based on dissolved zinc was less than 1.0.

While manganese had maximum-based HQs greater than 1.0 based on both total and dissolved concentrations, only 1 of 20 dissolved concentrations exceeded the background range, suggesting that manganese, in general, is consistent with background. Additionally, the mean concentrations of manganese based on total and dissolved data were less than the supplemental screening value. The maximum-based HQ for total vanadium was slightly greater than 1.0; however, based on dissolved concentrations, the HQ was less than 1.0.

Based on screening results, there is no acceptable risk from targeted inorganic constituents to ecological receptors.

6.3 Summary

Based on the available data, no significant risks to populations of ecological receptors were identified within Site UXO-02.

Conceptual Site Model

The conceptual site model (CSM), graphically depicted on **Figure 7-1**, is an essential element of a results-based environmental investigation and corrective action program. It is an important assessment tool that integrates the information needed to understand how COPCs move through the environment and potentially come in contact with human and ecological receptors. Development of a CSM is an iterative process; the model is refined as new information becomes available. The CSM is an effective tool in identifying additional data needs and supporting management decisions regarding sampling strategies, project constraints, and regulatory compliance. Key elements of the CSM are grouped into major categories identifying potential sources, the extent of contaminant migration, fate, and transport, and potential exposure pathways and receptors.

7.1 Source

This investigation did not identify direct evidence of surface MEC or environmental impacts from MEC related to historical range activities. Therefore, no source areas have been defined. Several metals (aluminum, antimony, arsenic, chromium, iron, manganese, and vanadium) have been detected at concentrations that exceed screening criteria in samples of groundwater and/or sediment. However, it is uncertain whether these elevated detections are related to historical land use practices.

7.2 Fate and Transport Mechanisms

Fate and transport analysis can guide assessment activities, improve understanding of the distribution of site contaminants, support risk assessments, and aid in identifying potential remedial alternatives, if necessary. A transport pathway describes the mechanisms whereby contaminants, once released, can be transported from a source to an exposure point. These pathways are influenced by the physical characteristics of the site such as climate, topography, geology, and hydrogeology, discussed in **Section 2**.

7.2.1 Sediments

MC, if present, at the ground surface and in surface water would have the potential to migrate into other environmental media such as sediments. The origin of the MC would likely be from military operations conducted within Site UXO-02. Potential release mechanisms include ammunition discharge and disposal and projectile impacts to the ground surface. This material would subsequently degrade over time, and be transported by erosional forces (surface water runoff and wind) to drainage features (e.g., wetlands) and deposited as sediments.

7.2.2 Groundwater

MC released at the ground surface could potentially become dissolved by precipitation and subsequently leach through the vadose zone until reaching the water table. Thereafter, the dissolved MC could be transported through the aquifer by groundwater flux. The rate and

direction of migration would be dependent upon the aquifer properties and chemical-specific characteristics.

7.2.3 Exposure Pathways and Receptors

An exposure pathway describes the potential route taken by a contaminant from the source to a receptor. The human health risk screening indicated that exposure to sediment, groundwater and possible MEC pose potential risks. For conservativeness, potential risks were assessed based on future residential use of the site to be protective of all potential receptors (e.g., residents, industrial workers, construction workers). The potential receptors evaluated during the human health risk screening included:

- Military personnel who may come into contact with sediments through dermal contact and accidental ingestion/absorption and physical contact with potential surface MEC during military exercises conducted within wetland portions of Site UXO-02.
- Future construction workers who may have contact with sediment and groundwater through dermal contact and accidental ingestion/absorption during potential future building activities that may include basement construction and wetland modification/containment. Construction workers may also have contact with potential surface or subsurface MEC.
- Site visitors and trespassers from the New River who may have dermal contact with sediment within the wetland areas and physical contact with potential surface MEC at Site UXO-02.

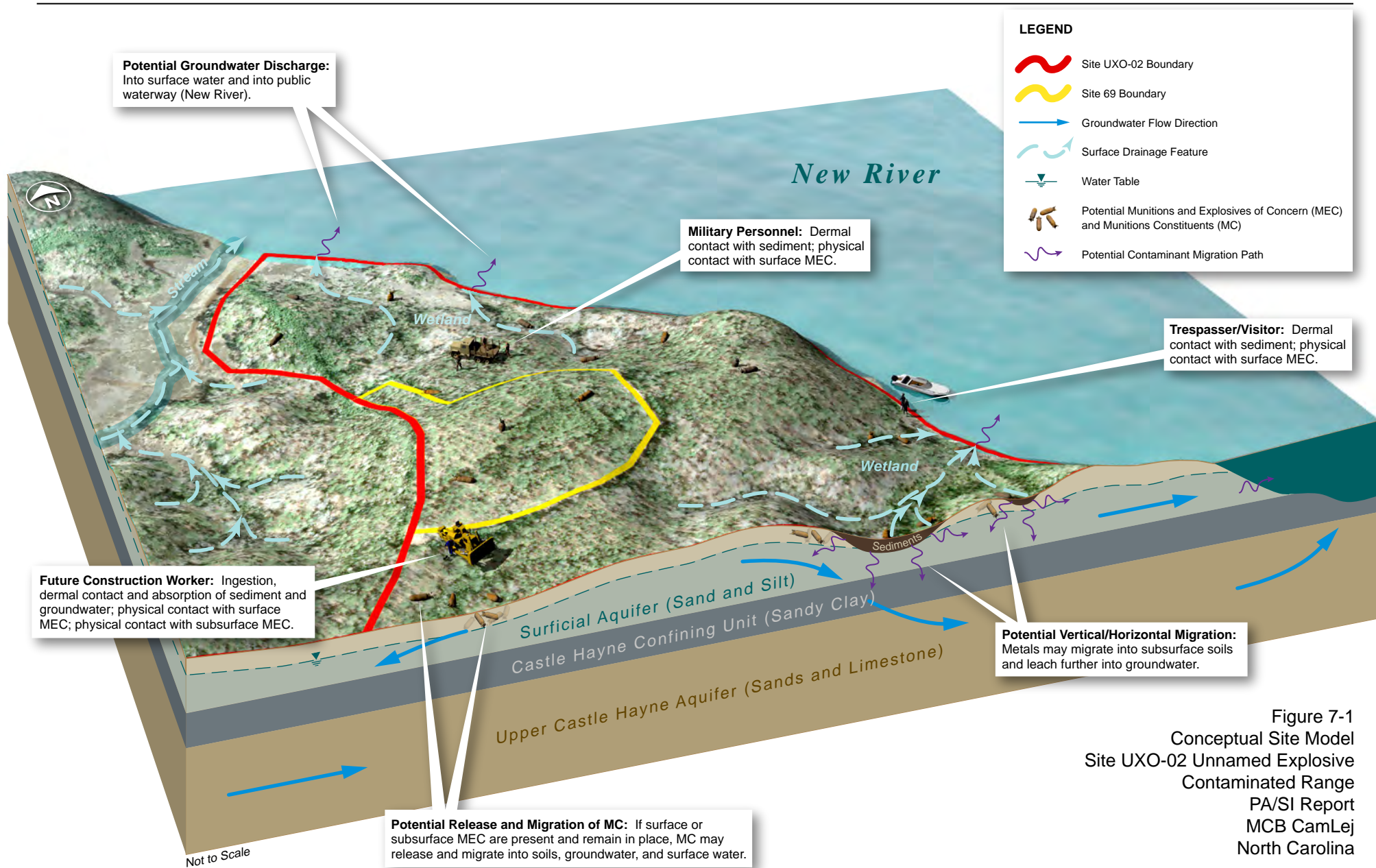


Figure 7-1
Conceptual Site Model
Site UXO-02 Unnamed Explosive
Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Conclusions and Recommendations

This section presents the PA/SI conclusions and provides recommendations for further study.

8.1 Conclusions

The site has been primarily used for platoon-level maneuvers from the 1960's to present and reportedly used as a mortar range from 1945-46 with firing positions along the southern boundary of the site.

8.1.1 Digital Geophysical Mapping

The DGM survey covered 11.3 acres of the accessible portions of the Site UXO-02 and identified 1,457 geophysical anomalies that represent potential subsurface MEC. Anomalies were widespread throughout the surveyed area. DGM could not be performed in areas of standing water. Intrusive investigation of the anomalies was not conducted during this phase of investigation; therefore, the nature of the anomalies was not determined.

8.1.2 Environmental Investigation

This investigation involved the collection of environmental media samples (i.e., surface soil, subsurface soil, groundwater, sediment and surface water) from locations throughout Site UXO-02. Subsequent laboratory analysis of these samples detected concentrations of one explosives residue and several metals in exceedance of their respective screening criteria.

A summary of the detected target analytes is provided below.

Surface Soil

Twenty metals were detected in surface soil samples that exceeded one or more of the regulatory screening criteria (**Tables 4-1** and **4-2**). One explosives residue, nitroglycerin, also exceeded soil screening criteria.

Subsurface Soil

Laboratory analysis of the subsurface soil samples indicated that 16 metals exceeded regulatory screening criteria (**Tables 4-3** and **4-4**).

Groundwater

Seventeen metals were detected in groundwater samples at concentrations which exceeded regulatory screening criteria (**Tables 4-5** and **4-6**). However, it is suspected that some of the metals exceedances detected in groundwater were due to the high level of turbidity measured in some of the samples. Wells that were found to yield turbid samples were also sampled for dissolved metals. As expected, the results of the dissolved metals analyses indicated lower concentrations of metals. However, exceedances of regulatory screening criteria were still recorded for dissolved iron and manganese.

Sediment

Five metals, aluminum, arsenic, chromium, iron, and vanadium, were detected in sediment samples at concentrations which exceeded regulatory screening criteria.

Surface Water

Arsenic, chromium, iron and manganese were detected in surface water samples at concentrations which exceeded regulatory screening criteria.

8.1.3 Human Health and Ecological Risk Screening

The preliminary human health risk-based screening indicated potential unacceptable risks associated with exposure to groundwater. However, exposure to the remaining media (surface soil, surface water, sediment and subsurface soil) is not anticipated to result in unacceptable human health risks. Therefore, no further assessment of surface soil, subsurface soil, surface water, and sediment is necessary to evaluate human health risks.

The ecological risk screening did not identify potential risks to ecological receptors, and further investigation of Site UXO-02 for this risk is unnecessary.

8.2 Recommendations

Based upon the preceding conclusions, the following recommendations are provided:

1. Investigate the nature of the 1,457 geophysical anomalies representing potential subsurface MEC detected during the DGM survey.
2. Conduct additional investigation of groundwater for metals constituents. Additional assessment of groundwater contamination should be completed under an expanded PA/SI for Site UXO-02 and the ongoing investigation of IR Site 69. The need for additional assessment of MC will be re-evaluated upon completion of the recommended intrusive investigation of geophysical anomalies.

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Appendix A
MRSP Site Summary Submittal to QA Panel

MRSPP SITE SUMMARY
SUBMITTAL TO QA PANEL

1. General: Provide the following general information:
 - a. Site name: **UXO-02, Unnamed Explosive Contaminated Range (ASR # 2.201)**
 - b. Site location: **MCB Camp Lejeune, North Carolina**
 - c. Cognizant FEC: **NAVFAC Mid-Atlantic**
 - d. Site POC **Robert A. Lowder**
Environmental Engineer
EQB/EMD/I&E
MCB, Camp Lejeune, NC 28542
Ph: (910) 451-9607
2. Munitions Type Known or Suspected: This section should address all munitions known or suspected to be present at the site including any practice or dummy munitions. This section should specifically address:
 - a. Munitions type(s) – Identify Mk, Mod, or other identification specifics. Address any bulk explosives or chemical warfare materials (CWM), including chemical agent containers or chemical agent identification sets (CAIS).

Site UXO-02 appears as an “unknown UXO contaminated area” in subsequent range overlay maps starting in 1987 (Figure 2-2 of Appendix B) (USACE, 2001). Based upon the range designations and use at other similar ranges on MCB CamLej, 60 millimeter (mm) and 81 mm mortar (practice, high explosive [HE] white phosphorus, illumination) may have been fired on Mortar Range “L-2” (USACE, 2001).

- b. Associated explosive fill or load – Identify for each of the munitions types
- c. Associated fuzing – Indicate if the fuzing is considered sensitive or not for each of the identified munitions types

Table 1. Types of Munitions and Fuzing at UXO-02 (USACE, 2001)

Types of Munitions Employed	Fuzing
Unknown Mortar Rounds	unknown

- d. Munitions determination – State if the munitions known or suspected to be present are UXO, damaged or undamaged DMM, or MC.

Munitions suspected to be present potentially include UXO. The results of PASI indicate that MC is not present.

3. Source of Hazard: This section addresses the source of munitions, including CWM, known or suspected to be present at the site. This section should specifically describe any:
 - a. Former bombing, grenade, maneuver areas, small arms, research, development, testing and evaluation (RDT&E) or other types of ranges or firing points. Identify any ranges used only for a particular type of munitions (e.g., small arms range).

The range appears on a range map circa 1973 and no information has been found to describe its use. Mortar range “L-2” was used from 1945-46. Mortar Range “L-2” had its firing position along the southern boundary of UXO-02 with impact trajectories due north into the New River.

- b. Former OB/OD or other munitions treatment sites.
- c. Former munitions burial sites.

Site UXO-02 encompasses a 14-acre portion of land known as IR Site 69; a site used from 1950 to 1976 for the disposal of chemical waste.

- d. Former munitions-related industrial areas used for the maintenance, manufacturing or demilitarization of munitions.
- e. Former missile defense or air defense artillery emplacement not associated with a range.
- f. Former storage or transfer points.

- 4. Location of Munitions: this section addresses the location of the known or suspected munitions and their potential to be exposed to receptors.
 - a. State if the presence of munitions is confirmed or suspected.

Presence of munitions is confirmed with an unfired U.S. SIGNAL, AIRCRAFT, AN-M43 (Red Star) signal flare discovered during the PA/SI

- b. Address if the evidence of the munitions presence is physical, historical, anecdotal or a combination of these sources.

Evidence is historical and physical. (CH2M HILL, 2009)

- c. Indicate if confirmed munitions are located on the surface, subsurface or both. **On the surface**
- d. For confirmed, subsurface munitions, state if the geological conditions are active or stable.
- e. Describe any barriers at the site that prevent direct access to any subsurface munitions (e.g., water depth in excess of 120 ft).

- 5. Ease of Access: This section addresses potential access to the MRS by considering barriers such as fencing or steep terrain that limit a receptor’s ability to enter the site.
 - a. State if there is a complete or partial barrier to the MRS.

The investigation area is mainly undeveloped and is generally flat with a topographical high within the hummocky terrain of Installation Restoration (IR) Site 69. Approximately 95 percent of Site UXO-02 is wooded with heavy undergrowth and delineated wetlands draining into the New River that comprises the eastern boundary of the site. The only cultural features existing at UXO-02 are the fenced perimeter of IR Site 69, a decommissioned power line running from the fenced perimeter northward, paralleling the New River and an access trail from Everett Creek Road.

- b. Describe any surveillance activities at the MRS and if they provide continual monitoring of access.

Surveillance activities do not occur at the MRS, beyond surveillance that occurs at the entire base. It is located within the base property. The area is undeveloped with access restricted to military personnel. The general public is precluded from entry to the area. (CH2M HILL, 2009)

- 6. Status of Property: This section addresses Navy control of the MRS.

- a. Indicate if the property was or is currently owned by, leased to, or otherwise possessed or used by the Navy. If the property has been transferred, indicate transferee and date of transfer.

The property is owned by the Navy and leased to the Marine Corps.

- b. Identify any property that is currently under Navy control, but is scheduled to be transferred from Navy control within 3 year.

None

- 7. Population/Activities: This section addresses the presence of potential receptors near the MRS.

- a. Based on U.S. Census Bureau data indicate the density of the surrounding population in persons per square mile within a 2-mile radius of the MRS boundary.

The density of the surrounding population is 24 persons per square mile within a 2-mile radius of the MRS boundary.

- b. Identify the total number of inhabited structures that are located within the MRS or within a 2-mile radius of the MRS boundary.

There are no structures within the MRS boundary. Approximately 184 structures are located within a 2 mile radius of the MRS boundary, at least 88 of them appear to be inhabited structures.

- c. Describe the activities occurring in or near these structures.

Administration, armory and classrooms for Base personnel.

- 8. Ecological/Cultural Resources: This section addresses the presence of ecological or cultural resources near the MRS.

- a. Identify if ecological or cultural resources or both are present on the MRS.

No cultural resources on or near the MRS have been identified.

Ecological resources are as follows. A bald eagle's nest is documented on MCB Camp Lejeune. The nest is located at the junction of Sneads Creek and the New River, 2.4 miles from Site UXO-02. Habitat is currently devoid of any of

the endangered or threatened species exists in the boundaries of UXO-02. No adverse impacts to listed species are expected to result from the proposed work at Site UXO-02. Project design features have been developed to prevent impacts to listed species. The following documents the threatened or endangered species of Onslow County, NC and those sighted on or near Camp Lejeune, NC. (CH2M HILL, 2008)

Table 2. Threatened or Endangered Species of Onslow County, NC (CH2M HILL, 2008)

Species	Federal Status	
American Alligator	T(S/A)	See Notes
Bald Eagle	BGPA	See Notes
Green Sea Turtle	T	Threatened
Leatherback Sea Turtle	E	Endangered
Loggerhead Sea Turtle	T	Threatened
Piping Plover	T	Threatened
Red-cockaded Woodpecker	E	Endangered
Shortnose Sturgeon	E	Endangered
West Indian Manatee	E	Endangered
Cooley's Meadowrue	E	Endangered
Golden Sedge	E	Endangered
Pondberry	E	Endangered
Rough-leaved Loosestrife	E	Endangered
Seabeach Amaranth	T	Threatened

Notes:

T(S/A) = threatened due to similarity of appearance

BGPA =Bald and Golden Eagle Protection Act

Many protected species have been sited near and on MCB Camp Lejeune. These include the American alligator, the green sea turtle, the loggerhead sea turtle, the piping plover, the red-cockaded woodpecker, bald eagle, seabeach amaranth, and the rough-leaf loosestrife. (USMC, 2006).

9. Health Hazard Evaluation (This information should be captured within the NORM database): This section addresses the potential hazards to receptors from MC and any incidental non-munitions related contaminants in four specific media. Appendix B of the MRSPF Primer contains the list of comparison values for the contaminants to be evaluated.
 - a. Identify and provide values for any contaminants present in background samples for the MRS.

No background samples were collected for this MRS; however, background samples are available for MCB Camp Lejeune. The background samples for MCB Camp Lejeune provide background concentrations of inorganics in surface soil, subsurface soil, and groundwater (Baker 2001; Baker 2002).

- b. Indicate the presence of any sole source drinking aquifer or use of groundwater as drinking source on or near the MRS. Discuss any water supply wells down gradient from the MRS. If possible, provide the EPA groundwater classification.

The closest active water supply well; PSW-BB47, is located 3.7 miles (mi) from Site UXO-02. The water supply well is 200 ft deep with an unknown screen length (AHEC, 2002). The public supply well is not expected to be impacted by the project site.

- c. List the uses for any surface water present on the MRS.

Delineated wetlands draining into the New River are present at Site UXO-02. The New River comprises the eastern boundary of the site.

- d. Discuss any evidence of contaminate migration from the MRS by any of the four media.

Metals contamination is present in wetland sediments and groundwater. There is currently no evidence of migration into surface water or soils.

- 10. Supporting documentation: Cite the sources for the information provided.

AH Environmental Consultants (AHEC). 2002. *MCB Camp Lejeune Wellhead Protection Plan 2002 Update, Marine Corps Base Camp Lejeune, North Carolina.*

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Appendix B

Archival Records Search Report

Final

**Archival Records Search Report for the Preliminary
Assessment/Site Inspection of Site UXO-02, Unnamed
Explosive Range ASR #2.201**

**Marine Corps Base Camp Lejeune
Jacksonville, North Carolina**

Contract Task Order 0014

November 2009

Prepared for

**Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic**

Under the

**NAVFAC CLEAN 1000 Program
Contract N62470-08-D-1000**

Prepared by



CH2MHILL

Raleigh, North Carolina

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Attachments

1	Resource Review Summary
2	Historical Aerial Photographs
3	Gas Identifier Technical Data Sheets

Acronyms and Abbreviations

CA	chemical agent
CAIS	chemical agent detector kit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CTO	Contract Task Order
CWM	chemical warfare materiel
°F	degrees Fahrenheit
DCE	dichloroethene
DGM	digital geophysical mapping
ESE	Environmental Science and Engineering, Inc.
ft	feet/foot
HE	high explosive
HTW	hazardous and toxic waste
IC	institutional control
IR	Installation Restoration
IROD	Interim Record of Decision
LTM	long-term monitoring
LUC	land use control
MC	munitions constituents
MCB	Marine Corps Base
MEC	munitions and explosives of concern
mm	millimeter
MNA	monitored natural attenuation
MRP	Munitions Response Program
NACIP	Navy Assessment and Control of Installation Pollutants
NAIP	natural attenuation indicator parameter
NARA	National Archives and Records Administration
NAVFAC	Naval Facilities Engineering Command
OU	operable unit
PA/SI	Preliminary Assessment/Site Inspection
PCB	polychlorinated biphenyl
RI	Remedial Investigation
ROD	Record of Decision
SVOC	semivolatile organic compound
U.S.	United States
UXO	unexploded ordnance
VOC	volatile organic compound
WW II	World War II

SECTION 1

Introduction, Purpose, and Scope

The United States Marine Corps and Naval Facilities Engineering Command (NAVFAC) are in the process of investigating closed ranges at the Marine Corps Base (MCB) Camp Lejeune following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation process. A munitions response program (MRP) Preliminary Assessment/Site Inspection (PA/SI) included under Contract Task Order (CTO)-0014 will be conducted at Site Unexploded Ordnance (UXO)-02 Unnamed Explosive Range Archive Search Report (ASR) #2.201 in order to accomplish the following objectives:

- Identify historical activities at Site UXO-02 that may have resulted in environmental contamination with munitions and explosives of concern (MEC) or munitions constituents (MC)
- Evaluate the presence and nature of any MC and/or HTW contamination that may exist at Site UXO-02
- Conduct ecological and human health risk screenings on analytical data collected at Site UXO-02
- Estimate the number and density of geophysical anomalies that may represent subsurface MEC
- Provide geophysical data for future MEC intrusive investigations

The results of the environmental investigation will determine if any impacts to soil, groundwater, and surface water have occurred at Site UXO-02 due to past range activities. To support site investigation effort, this Archival Records Search Report has been prepared to provide a narrative of the historical activities at Site UXO-02 that may have resulted in environmental contamination with MEC.

Figure 1-1 shows the site in relation to the entire base.

The Archival Records Search Report is an investigative review of existing information about the site and its surrounding area, with an emphasis on obtaining information from personnel and historical resources that might indicate a potentially hazardous release to the environment. The scope of the report includes:

- A review of existing information about the site (including MCB Camp Lejeune maps, drawings, reports, and interviews with MCB Camp Lejeune personnel)
- Collection of additional information about the site.

A complete listing of resources identified and investigated for this report is provided in **Attachment 1**. **Attachment 1** also includes details concerning the reviews of the historical information from the Alfred M. Gray Research Center at MCB Quantico, National Archives and Records Administration (NARA) map and text files, and Camp Lejeune base files. **Attachment 2** contains photographs obtained during the research activities.



Site Information

2.1 Facility Information

MCB Camp Lejeune is located on the Atlantic coast in Jacksonville, North Carolina. The city of Jacksonville in Onslow County is the principal support community for the base. MCB Camp Lejeune occupies 153,000 acres including more than 450 miles of roads, approximately 6,800 buildings and facilities, and 14 miles of beach on the Atlantic Ocean for amphibious training. Approximately 14,000 acres of land have been developed for administrative, maintenance, logistics and personnel support facilities. Originally established in 1941, the base is home to several tenant commands including II Marine Expeditionary Force, 2nd Marine Division, and 2nd Marine Logistics Group, two Navy commands, one Coast Guard command, and several Marine Corps formal schools. MCB Camp Lejeune supports a total population of approximately 150,000 people, including active duty military and dependants, retirees, and civilian employees (Global Security, 2008).

2.2 Ownership and Operational History

2.2.1 Camp Lejeune Ownership History

The history of the land now occupied by Camp Lejeune is documented primarily through land records and maps. Following the start of World War II (WW II), the War Department began purchasing tracts of land in 1941 from local residents to meet the need for an East Coast amphibious training facility. Prior to occupation by the Marine Corps, the land had been occupied by white and African-American communities and farms since the Colonial era. The land contained plantation houses, cabins, farm buildings, tobacco barns, stores, and various cemeteries (Global Security, 2008).

The initial land transferred to the government was acquired in 14 different transactions between April and October 1941 and totaled 173.8 square miles or 111,155 acres, of which there were 85,155 land acres and about 26,000 acres under water (Loftfield, 1981; Louis Berger Group, 2002). The individual tracts of land were grouped into various “areas” for consolidation.

2.2.2 Site UXO-02 Unnamed Explosive Range ASR #2.201

Site UXO-02 is approximately 127 acres in area and is located in the Stones Bay area of Camp Lejeune (**Figure 1-1**). Site UXO-02 is found by entering at the Stones Bay Gate and taking the Red Trail to Everett Creek Road. The site is identified in the *Range Identification and Preliminary Range Assessment* (USACE, 2000) as ASR #2.201. The area is primarily wooded and bordered on the west side by the New River. Site UXO-02 encompasses a 14-acre portion of land known as Installation Restoration (IR) Site 69/ Operable Unit (OU) 14 – Rifle Range Chemical Dump. **Figure 2-1** shows Site UXO-02, Site 69, and monitoring well

locations from previous investigations. Site UXO-02 is located on military grid squares 7728 and 7828.

The 1946 Range overlay map (Plate 4 of USACE, 2001; **Figure 2-2**) shows Mortar Range L-2. Mortar Range L-2 was established in a 1945 Camp Training Order; however, by March 1946, it was disestablished and no longer used for firing live ammunition. According to the *Archives Search Report for the Final Range Identification and Preliminary Range Assessment*, Mortar Range L-2 was positioned at latitude 34° 34' 29" N, longitude 77° 25' 43" W, or Military Grid 7721 2862 (2001). Based upon the range designations and use at other similar ranges on Camp Lejeune, 60 millimeter (mm) and 81 mm mortars (high explosive [HE], white phosphorus, illumination) were fired from Mortar Range L-2 (USACE, 2001).

Site UXO-02 appears as an “unknown UXO contaminated area” in subsequent range overlay maps starting in 1987 (Plates 18 and 20 in USACE, 2001). **Figure 2-2** shows the progression of Site UXO-02 on the range overlay maps.

The Camp Lejeune Existing Conditions Maps, which begin in 1944 and indicate buildings, roads, wells, and other developments over the entire base, do not include any buildings or other features in the area of Site UXO-02. Historical information and previous investigations are focused on Site 69; no known investigations have been conducted in other areas of Site UXO-02.

Records indicate that the site was an active dump from the early 1950's until 1976.

Figure 2-3 shows Site UXO-02 and Site 69 in a 1962 historical aerial photograph. Site 69 is cleared and appears to be in use, and the majority of UXO-02 that is outside of Site 69 is wooded.

From 1950 to 1976, Site 69 was used for the trench disposal of chemical wastes, including polychlorinated biphenyls (PCBs), solvents, and pesticides. Site 69 also has a suspected history of chemical agent (CA) disposal. Fifty to sixty 55-gallon drums of mustard or nerve agent were allegedly buried in two trenches at Site 69 (Water and Air Research, 1983). Chemical Agent Detector Kits, similar to the M18A2, have been observed at the site and has led to speculation of the potential for the presence of Chemical Agent Identification Sets (CAIS) (e.g., K941, K951). However, no physical evidence to support the presence of CAIS has been discovered (Baker, 2000). Data sheets on CAIS and Chemical Agent Detector Kits from the *Range Identification and Preliminary Range Assessment* (USACE, 2000) are provided in **Attachment 3**.

Investigations conducted at Site 69 to date have focused on hazardous waste contamination not related to chemical warfare materiel (CWM). CA monitoring was performed during all intrusive activities for health and safety reasons; low concentrations were detected in surface soil in the southern portion of Site 69 (Baker, 2000).

From February 1982 to February 1983, an initial assessment study for the Navy Assessment and Control of Installation Pollutants (NACIP) Program was conducted by consultants with Water and Air Research, Inc. Site 69 was identified as a top environmental priority (Water and Air Research, 1983). By 1989, Site 69 was wooded with little evidence of clearing activities (**Figure 2-4**).

From 1984 to 1986, Environmental Science and Engineering, Inc. (ESE) performed a Confirmation Study of Site 69, which included installation of eight monitoring wells (69-GW01 through 69-GW08), collection of groundwater from the eight wells, with additional collection of four surface water/sediment samples (Baker, 2000).

In 1990 a chain-link fence was erected to restrict access to the disposal area. However, review of historical aerial photography, specifically from 1964, suggests that an area of disposal may lie to the north of the fenced area, **Attachment 2**.

In 1991, ESE conducted a Supplemental Characterization, which included the collection of eight groundwater samples, seven surface water samples, and seven sediment samples. The results of these studies revealed that shallow groundwater exhibited elevated levels of volatile organic compounds (VOCs) in the southern portion of the site. Surface water samples obtained from onsite standing water in low-lying areas of the site revealed the same constituents as were detected in shallow groundwater, but at much lower concentrations (ESE, 1992).

From January 1994 through April 1996, Remedial Investigation (RI) field investigation activities by Baker Environmental, Inc. were conducted in five stages to characterize the nature and extent of contamination. A total of 29 shallow soil borings and nine subsurface soil borings were completed to characterize soil quality; two geophysical surveys were conducted to identify subsurface anomalies; and a total of eight shallow, six upper zone Castle Hayne, three intermediate zone Castle Hayne, and three deep zone Castle Hayne monitoring wells were installed. Five rounds of groundwater samples were collected from various monitoring wells and via “hydropunch” technique. Samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), pesticides, PCBs, inorganics, and chemical warfare materiel (CWM) degradation compounds. The analytical results indicated that groundwater in the shallow aquifer as well as in the upper and intermediate portions of the Castle Hayne aquifer under the former disposal area have been impacted by VOCs (primarily 1,2-dichloroethene [DCE]). Based on groundwater concentrations and the results of the geophysical survey, which identified metallic debris in the subsurface, the source of the VOCs appeared to be associated with buried waste near well cluster 69-GW15. However, the true location of source material remained unconfirmed due to the suspected presence of buried CWM. The analytical results also indicated that no soil contamination is present at the Site. Surface water samples indicated that onsite ponded water in the southern portion of the site has been impacted with VOCs; offsite surface water and sediment samples indicated the New River, Everett Creek, and an unnamed tributary north of the site had not been impacted by site activities. Additionally, acetophenone, a CWM degradation compound, was detected in several surface soil samples, and onsite and drainage sediment samples. Baker concluded that the presence of acetophenone was attributable to training activities using “riot gas” (Baker, 2000).

In March 1996, a Treatability Study was conducted to evaluate the use of in-well aeration to remediate groundwater. The study deemed in-well aeration ineffective after 2 years of operation (Baker, 2000).

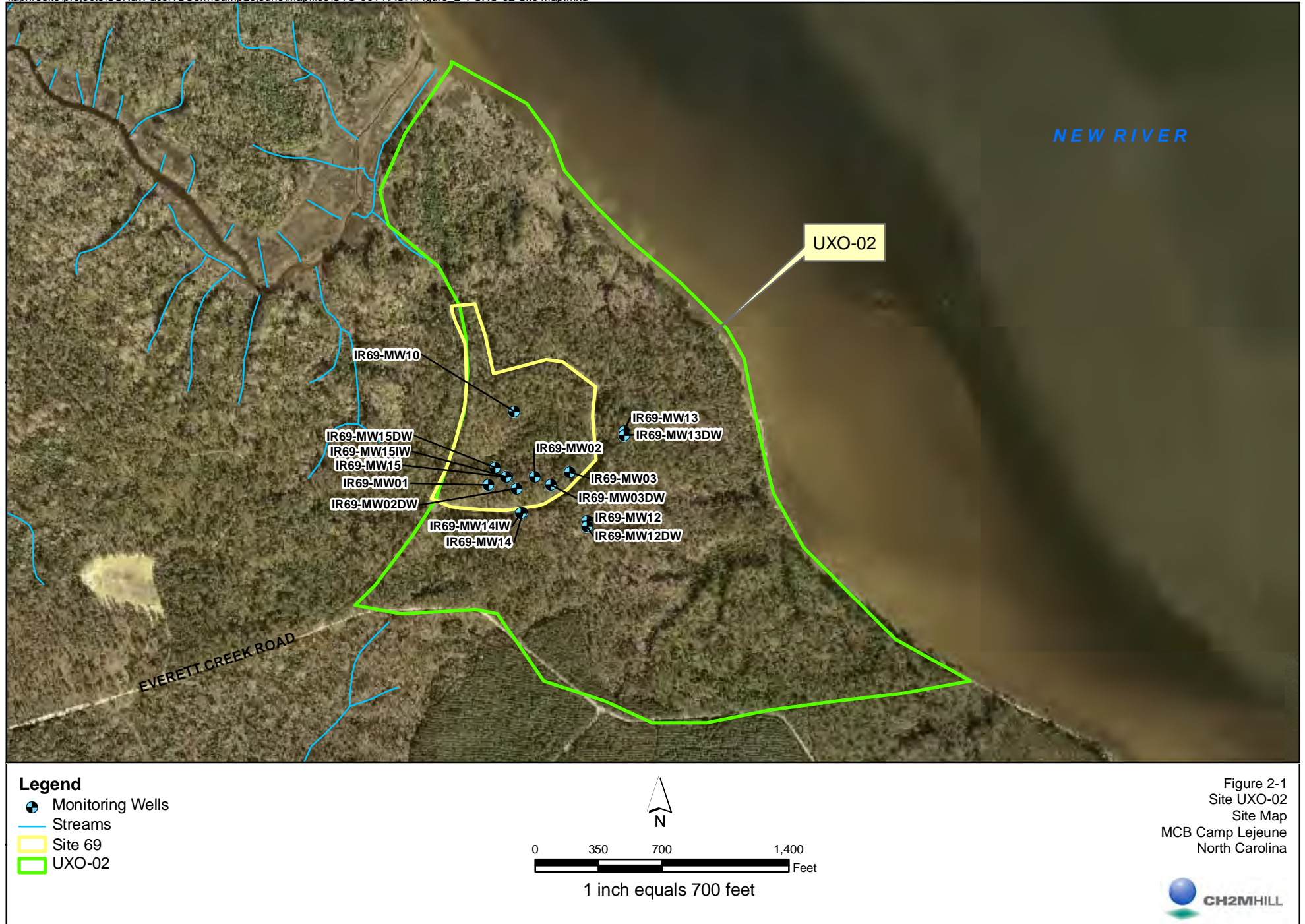
Long-term monitoring (LTM) of the site began in April 1998 on a semiannual basis in order to fully assess plume stability and monitor seasonal changes. Groundwater samples are collected from eight shallow monitoring wells screened in the surficial aquifer, six deep

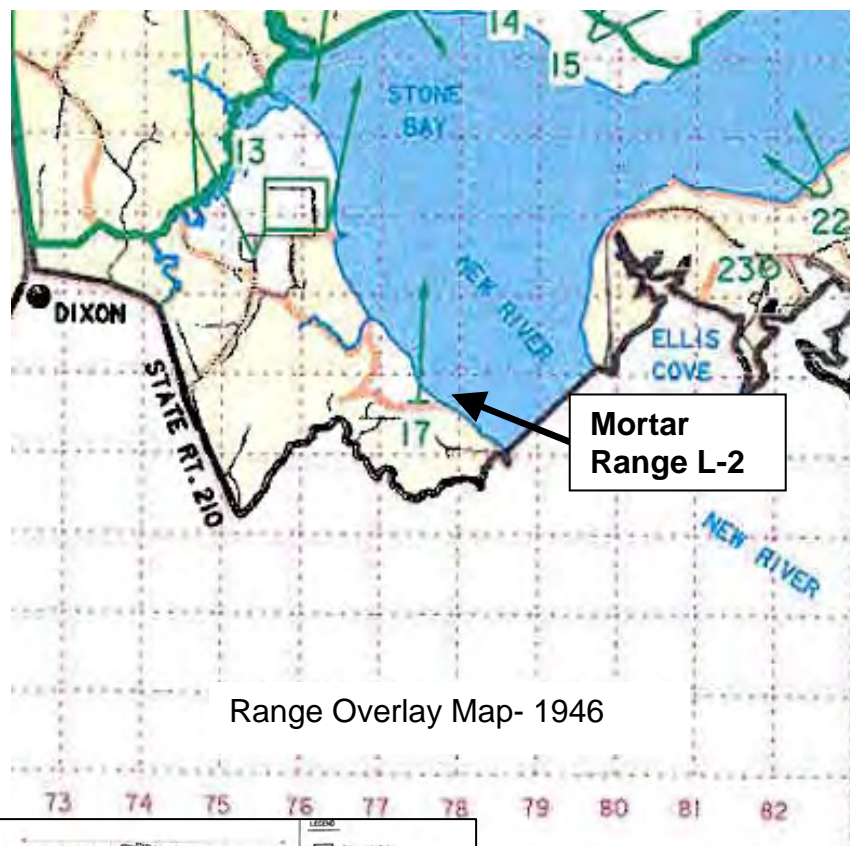
monitoring wells screened in the upper zone of the Castle Hayne aquifer, and one deep monitoring well screened deeper in the Castle Hayne aquifer. Groundwater samples collected under this program are analyzed for VOCs and natural attenuation indicator parameters (NAIP) (Baker, 2000).

In June 2000, an Interim Record of Decision (IROD) was issued (Baker, 2000) to address the human health and ecological risks due to VOCs in groundwater and human safety risks due to buried CWM. Institutional controls (ICs) and monitored natural attenuation (MNA) were the selected remedial actions, which are required to remain in effect until the remedial goals have been achieved or the IROD is superseded by a Final Record of Decision (ROD). The remedial actions presented in the IROD included the following:

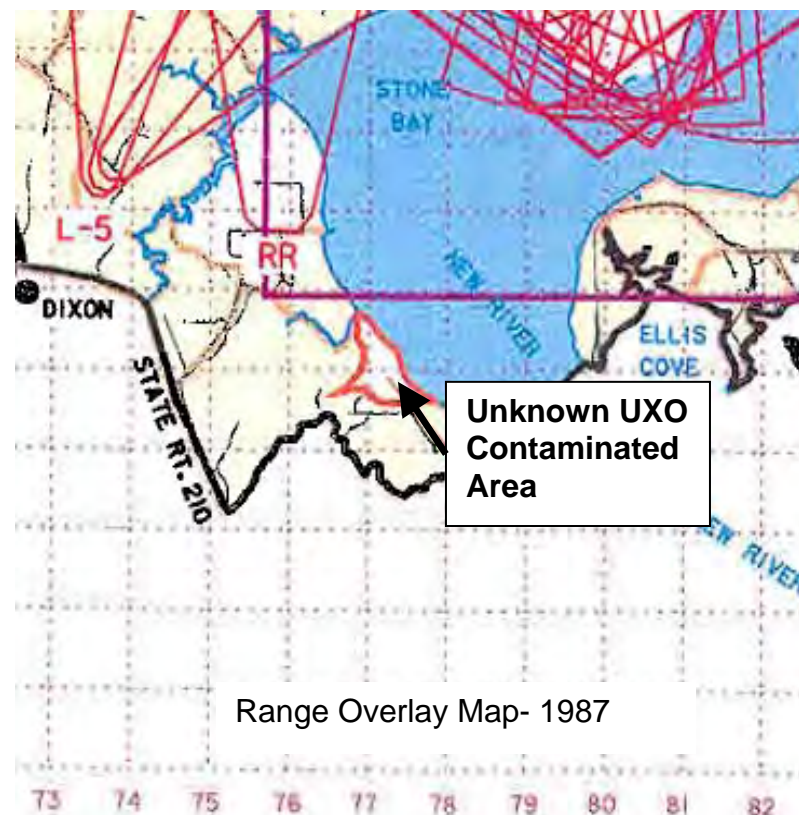
- Implementing a groundwater monitoring program targeting the VOCs of concern
- Conducting groundwater monitoring of inorganics and CWM degradation products in select wells
- Implementing land use controls (LUCs) and aquifer use controls (shallow and Castle Hayne aquifers) to prevent site access, control intrusive activities, and prevent future use of the aquifers

As of 2008, site activities for Site 69 include long-term groundwater monitoring and an ongoing RI performed by CH2M HILL to better characterize the extent of contamination. Current data levels performed to date are insufficient to support a corrective action decision (CH2M HILL, 2008).

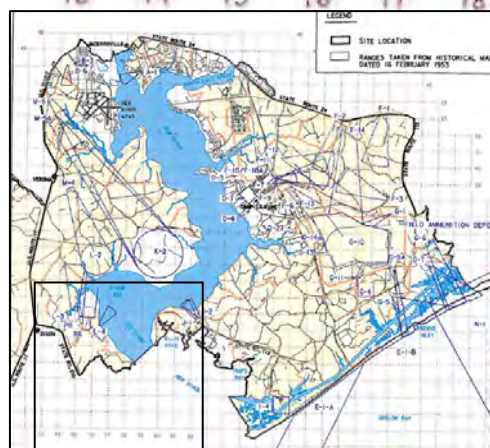




Range Overlay Map- 1946



Range Overlay Map- 1987



Source: USACE, 2000



Approximate Scale in Meters



Figure 2-2
Site UXO-02
Range Overlay Maps – 1946, 1987
MCB Camp Lejeune
North Carolina







Legend
Site UXO-02
Site 69

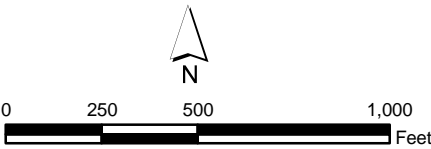


Figure 2-4
Site UXO-02
Historical Aerial – 1989
MCB Camp Lejeune
North Carolina



SECTION 3

References

Baker Environmental, Inc. (Baker). 2000. *Final Interim Record of Decision for Operable Unit No. 14 (Site 69), Marine Corps Base Camp Lejeune, North Carolina*. June.

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Cardinell, A. P, S. A Berg, and O. B. Lloyd, Jr. 1993. *Hydrogeologic Framework of U.S. Marine Corps Base at Camp Lejeune, North Carolina*. U.S. Geological Survey: Water Resources Investigations Report 93-4049.

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Harned, D. A., O. B. Lloyd, Jr., and M. W. Treece, Jr. 1989. *Assessment of Hydrologic and Hydrogeologic Data at Camp Lejeune Marine Corps Base, North Carolina*. U.S. Geological Survey Water-Resources Investigation Report 89-4096, 64p.

Environmental Science and Engineering, Inc. (ESE). 1992. *Final Site Assessment Report for Sites 6, 48 and 69: Characterization Study to Determine Existence and Possible Migration of Specific Chemicals In Situ*. MCB Camp Lejeune, North Carolina. Naval Facilities Engineering Command Atlantic Division Contract # N62470-83-C-6106. March.

Loftfield, Thomas C., Principal Investigator. 1981. *Archeological and Historical Survey of USMC Base, Camp Lejeune*. Naval Facilities Engineering Command Norfolk, Coastal Zone Resource Corp, Vol. II. Contract # N62470-79-C-4273. University of North Carolina, Wilmington. August.

Louis Berger Group, Inc. 2002. *Semper Fidelis: A Brief History of Onslow County, North Carolina and MCB, Camp Lejeune, 2002*, U.S.M.C. LtCol Lynn J. Kimball (USMC Retired) USACE Wilmington District Contract DACWS4-99-C-0004.

United States Army Corps of Engineers (USACE). 2000. *Final Range Identification and Preliminary Range Assessment, Marine Corps Base Camp Lejeune, Onslow, North Carolina*. St. Louis District. February.

USACE. 2001. *Archives Search Report for the Final Range Identification and Preliminary Range Assessment, Marine Corps Base Camp Lejeune, Onslow, North Carolina*. St. Louis District. December.

Water and Air Research. 1983. Water and Air Research, Inc. *Initial Assessment Study of Marine Corps Base, Camp Lejeune, North Carolina*. Prepared for Naval Energy and Environmental Support Activity.

Winner, M. and R. Coble. 1989. *Hydrogeologic Framework of the North Carolina Coastal Plain Aquifer System*. U.S. Geological Survey Open File Report 87-690.

Attachment 1
Resource Review Summary

ATTACHMENT 1

Resource Review Summary

The following table provides a summary of the specific references identified for review, interview, or contact for the archival report.

Resource	Actions Completed
Quantico, Virginia, Marine Corp History Division, Historical Research Branch (Kara Newcomer and Lena Kaljot)	Reviewed all available file folders related to Camp Lejeune and copied relevant reports and figures/maps (August 19, 2008)
Quantico, Virginia, Marine Corp Library Gray Research Center (Greg Cina)	Reviewed all maps related to Camp Lejeune and copied relevant maps (August 19, 2008)
US National Archives (NARA II) Historical Files	Reviewed text and drawing files from Text and Cartographic Divisions (August 20-22, 2008)
Camp Lejeune Personnel	
Andrew Smith, Environmental Management Division	Contacted and interviewed (August 21, 2008)
Dennis Dunham and Jerry Jordan (intern), Public Works Technical Records	Contacted and interviewed (August 15 and August 21, 2008)
Julie Rowe, MCB Camp Lejeune Archivist	Contacted and phone interviewed (August 21, 2008)
Duane Richardson, Base Range Safety Officer	Contacted and interviewed (August 15, August 21 and September 12, 2008)

Marine Corp Library Review

History Division: Text

Contact: Kara Newcomer
Historian, Historical Reference Branch
Quantico, Virginia
(703) 432-4872 DSN 378
kara.newcomer@usmc.mil

Site Visit: August 19, 2008

File review at Marine Corps Base, Quantico, VA, Historical Reference Branch.

Files found under **Posts and Stations: N.C., Camp Lejeune** included Activities, Guides and Base Litter, History, Maps, Administrative Papers, Linage and Honors, Acquisition and Jurisdiction and Health Survey 2000.

Copied:

1. Training Areas and Facilities. February 16, 1953. Relevant site information and maps of ranges.
2. Camp Lejeune, North Carolina. February 10, 1942. Map of area.

3. Camp Lejeune: Early History. June 1942. Discusses "Miscellaneous Marine Corps Training."
4. Brief History of Camp Lejeune, North Carolina. August 15, 1954
5. Commandant Letter dated August 25, 1951 – Subject – "Twelve quartermaster warehouses for Camp Lejeune, North Carolina; further justification for."
6. Camp Lejeune General Map. Date unknown. Map of area.

History Division: Photographic Division

Contact: Lena Kaljot

Photo Historian, Historical Reference Branch

Quantico, Virginia

(703) 432-4873 DSN 378

Lena.kaljot@usmc.mil

Site Visit: August 19, 2008

Photo review at Marine Corps Base, Quantico, VA, Historical Reference Branch.

Photo files found under **Lejeune** included Administrative Buildings, Aerial Views: 1940s, Aerial Views: 1950-1960, Aerial Views: undated, Aerial Views: 1948, Chapels, Ice Cream Plant, Lumber, Medical, Misc., Mess Hall; Housing, Recreation, Public Works, Storage, Training and Utilities.

Copied:

1. Aerial Photos: Camp Lejeune, NC. Various angles. May 6, 1948.
2. Aerial Photos: Tent Camp, Camp Lejeune. Various angles. June 1946.
3. Aerial Photos: Tent Camp, Camp Lejeune. Various angles. September and December 1948.
4. Aerial Photo: Tent Camp, Camp Lejeune. September 1951.
5. Aerial Photos: Division Training Area, Camp Lejeune. Looking West. September 1948.
6. Aerial Photo: Division Training Area, Camp Lejeune. Looking East. December 23, 1948.
7. Aerial Photo: Magazine Area, Camp Lejeune, NC. Looking South. September 17, 1948.
8. Aerial Photo: Officers Quarters, Camp Lejeune. October 13, 1948.
9. Aerial Photo: Officers Housing Area, Camp Lejeune, NC. September 14, 1951.
10. Aerial Photo: Montford Point, Camp Lejeune, NC. September 22, 1948.
11. Aerial Photo: Camp Knox Area, Camp Lejeune. Looking North. September 22, 1948.
12. Aerial Photo: Rifle Range Area, Camp Lejeune. Various angles. September 17, 1948.
13. Aerial Photo: Rifle Range Area, Camp Lejeune, NC. September 14, 1951.
14. Aerial Photo: Airfield, Camp Lejeune, NC. September 16, 1948.
15. Aerial Photo: New River Administration Building and Circle, Camp Lejeune. August 22, 1944.
16. Aerial Photo: MCAAF Camp Lejeune, NC. October 30, 1947.
17. Aerial Photo: USMCAF, Camp Lejeune, NC. November 5, 1951.
18. Aerial Photo: Peter Point Field, MCAAF, Camp Lejeune, NC. April, 13, 1948.
19. Aerial Photo: Peter Point Field, Camp Lejeune, NC: Building No. PP-106.
20. Seven Aerial Photos of "Unknown dates and locations."

Achieve and Special Collections: Maps

Contact: Greg Cina
 Archivist, Achieves and Special Collections
 Quantico, Virginia
 (703) 784-4685
 cinagl@grc.usmc.edu
 Site Visit: August 19, 2008

Map review at Marine Corps Base, Quantico, VA, Achieves and Special Collections in Gray Research Center.

Maps were the only items in the collection pertaining to Camp Lejeune. Reviewed 12-15 maps all pertaining to Camp Lejeune through time.

Copied:

1. Topographical Map: Sneads Ferry, N.C. 1971.
2. Topographical Map: New River Inlet, N.C. 1971
3. Topographical Map: New River N.C. 1972
4. Topographical Map: Approaches to the New River. 1956

National Archives and Records Administration Review

Text Division

Site visit: August 20-22, 2008

Below are the topics and boxes of files reviewed in association with the Marine Corps.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. USMC Exercises, 1960-1983. 170A/54/07, Boxes 1-2.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Record of Training Exercise and Maneuvers, 1941-1950. 370/23/22 Boxes 5-15.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Division of Public Information, General Correspondence, 1942-1950. 370/23/18 Box 1.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Command Chronologies, 2nd Marine Regiment, 1965-1979.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Command Chronologies, 2nd Marine Regiment, 1st Marine Battalion, 2nd Marine Battalion, 3rd Marine Battalion, 1965-1972.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Record of Field Organizations: 2nd Marine Division Regimental Orders and Other Issuance, 1951-1953. Boxes 1-11.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Record of Field Organizations: 2nd Marine Division, 10th Marine Regiment, 6th Marine Regiment and 8th Marine Regiment, 1960-1983. Boxes 1-11.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Ordnance, 1939-1950, Box 501.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Infantry Weapons, 1945, Box 508.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Geography, Boxes 885-886.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Experiments, Grenades, and Explosives, Box 1206.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. SOPs, Boxes 1158-1159.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Pistols, Box 1237.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Training Bullitins-1943, Box 1437.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Reports. Boxes 1470-1476.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Ranges. Box 1990.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Practice/Teams Pistols. Boxes 1994-1995.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Marine Corps Communications. Boxes 1059-1064.

Record Group 127 (USMC), Records of the USMC, Offices of the Commandant, General Correspondence, January 1939-1950. Co. Drills and Instructions. Boxes 1076-1082.

The boxes contained information primarily related to weapons test results, weapons cost distribution, weapons training classes, weapon specifications, and cleaning and maintenance. The material was not specific to Camp Lejeune and included information for several MC bases.

Record Group 127 (USMC), Camp Lejeune, Command Chronologies, 1965-1979, Boxes 690-698.

List of Documents Obtained from National Archives

1. "Memorandum for the Personnel Division." June 6, 1942.
2. "Modification No. 2 to General Order Number 163: Training Facilities and Regulations Governing the Use of." October 11, 1942.
3. "Memorandum to the Quartermaster: Fuel Thickener (Napalm) for Flame Thrower H1A1." January 5, 1944.
4. "Marine Corps Training Bulletin: Use of Chlorine in Training" January 19, 1944.
5. Commandant Letter dated May 13, 1944 – Subject – "Chemical Warfare Class"
6. Commandant Letter dated May 19, 1944 – Subject – "Chemical Warfare Instruction"
7. Commandant Letter dated May 30, 1944 – Subject – "Chemical Warfare Class"
8. Commandant Letter dated July 7, 1944 – Subject – "Requirement Factors for Flame Thrower Fuels."
9. "Administrative Command Training Memorandum Number 5-44: Chemical Warfare." July 14, 1944.
10. Commandant Letter dated August 12, 1944 – Subject – "Chemical Warfare Training"
11. Commandant Letter dated September 6, 1944 – Subject – "Chemical Warfare Training"
12. Commandant Letter dated September 19, 1944 – Subject – "Distribution of Chemical Warfare Letter"
13. Commandant Letter dated December 2, 1944 – Subject – "Compressed Gases"
14. Commandant Letter dated December 15, 1944 – Subject – "Flame Thrower Expendable Supplies, requirement factors for."
15. "Marine Barracks Camp Lejeune Annual Report, North Carolina, Naval District Five." October 1, 1946.
16. "Camp General Order Number 163: Training Facilities and Regulations Governing the Use of." August 17, 1949.
17. "Lesson Plans for Training of the Organized Reserves" June -September 1950.
18. "Regimental General Order Number 39: Defense against Chemical and Radiological Warfare." August 28, 1951.
19. "Regimental Training Order Number 157-52: Training Schedule 4.2 Mortar Co, 16-21 June 1952." June 10, 1952.
20. "Regimental Training Order Number 180-52: Training Program 1 July to 30 September. 1952." June 30, 1952.
21. "Regimental Training Order Number 241-52: Training Program 1 October to 31 December 1952." September 29, 1952.

22. "Regimental Training Order Number 259-52: Preliminary Marksmanship Training Schedule for 6th Marines and attached Division Units from 4 to 11 October 1952." October 3, 1952.
23. "Regimental Training Order Number 9-53: Training Program 6 July-3 October 53" June 24, 1953.
24. "Change No.2 to Regimental Training Order Number 8-53: Training Facilities, Maneuver Areas and Firing Ranges" August 20, 1953.
25. "Regimental General Order 92: Interior Guard" October 20, 1953.

Cartographic Division

Site visit: August 22, 2008

Information for Camp Lejeune is located under Record Group (RG) 71-Bureau of Yards and Docks. The index for locating cartographic materials is then grouped by subject codes. The only available drawing for Camp Lejeune was for Subject Area 19- Water Systems, which contained no relevant materials. Subject Areas 44 is Rifle ranges, machine gun ranges, sighting ranges, bombing targets; however, no materials were located under this Subject Area.

MCB Camp Lejeune Base Records Review

Contact: Andrew Smith

Environmental Engineer, Environmental Management Division
Marine Corps Base, Camp Lejeune
(910) 451-9017
stephen.a.smith2@usmc.mil

Andrew provided electronic color copies of the RI/PRA Range Overlay Maps. Also suggested looking in documents that CH2M HILL has access to, including:

- US Army Corps of Engineers (USACE), St. Louis District. 2000. *Final Range Identification and Preliminary Range Assessment*, Marine Corps Base Camp Lejeune, Onslow, North Carolina, February.
- US Army Corps of Engineers (USACE), St. Louis District. 2001. *Archives Search Report for the Final Range Identification and Preliminary Range Assessment*, Marine Corps Base Camp Lejeune, Onslow, North Carolina, December.
- Water and Air Research. 1983. Water and Air Research, Inc. *Initial Assessment Study of Marine Corps Base, Camp Lejeune, North Carolina*. Prepared for Naval Energy and Environmental Support Activity.

Contact: Duane Richardson

Base Range Safety Officer
Marine Corps Base, Camp Lejeune
(910)451-1240
Duane.richardson@usmc.mil

Per email and phone conversations Duane described the areas as follows:

“Site UXO 02 ASR Area 2.201: This one could be a hard one. Other than the list in the manual you have, I have nothing on file. It was very common to bury ammunition, ammunition dunnage, trash in those days and I would be very surprised if we don't have soil and water contamination of some type, to some degree. I am surprised it was so close to the water. This area is heavy wooded now and I am not aware of anything being done in that area after the late 1970. This area will need to be inspected in detail.

Contact: Dennis Dunham
Technical Records, Public Works Office
Marine Corps Base, Camp Lejeune
(910) 451-2818 ext 273

Per phone and e-mail conversations provided existing conditions maps. All maps and plans have been converted to electronic files and Dennis is happy to look up any information needed on builds and any civil work, sewage, electrical, etc.

Existing conditions for the all available areas of the base were provided for the following years:

1943, 1946 through 1960, 1963, 1966, 1985 and 2005.

Contact: Julie Rowe
Archivist, Combat Camera
Marine Corps Base, Camp Lejeune
(910) 451-1238

The archivist position at Camp Lejeune was created about a year ago and is still in development. Currently the office holds photos and oral histories of the main area of Camp Lejeune and the collection is growing. Julie did not have any information related to historical use of range areas.

Documents Reviewed at the Base Library

Site Visit: August 20 and 21, 2008

1. Lotfield, Thomas, C. Principal Investigator. UNCW, August 1981. *Archeological and Historical Survey of USMC Base, Camp Lejeune; Naval Facilities Engineering Command Norfolk, Coastal Zone Resource Corp., Vol. II, Contract No. N62470-79-C-4273.*
2. Camp Lejeune Marines, On Land, On Sea, In the Air. Pamphlet (several from 1944 – 1988).
3. Carraway, Gertrude S. Camp Lejeune Leathernecks, United States Marine Corps Training Center, Camp Lejeune, North Carolina. October 1946.
4. Baker Environmental, 1992, Administrative Record (CTO-0021) *Section 1: Site Identification- Correspondence.* May

Copies from Baker Source:

5 Pages from “Doc. No: CLEJ-00648-01.02-02/20/81” (Related to site 69)

5 Pages from “Doc. No: CLEJ-00226-1.02-01/01/01” (Related to site 69)

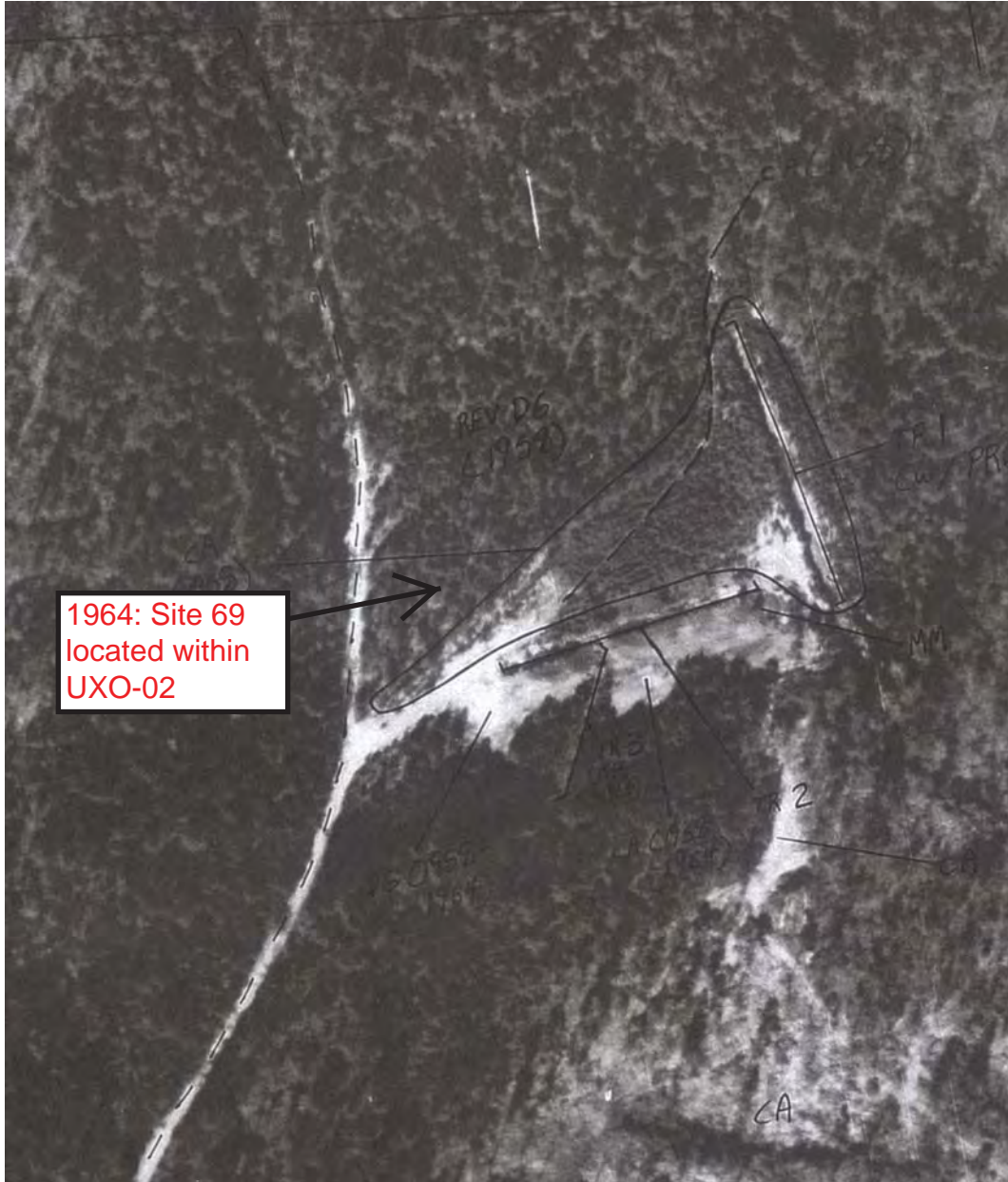
1 Page from “Doc. No: CLEJ-00208-1.01- (unable to read date at the top of page, the date of the memo is 11/22/82)

1 Page from “Doc. No: CLEJ-0090(?)-1.01-9/11/83”

13 Pages from “Doc. No: CLEJ-00247-1.02-10/25/85”

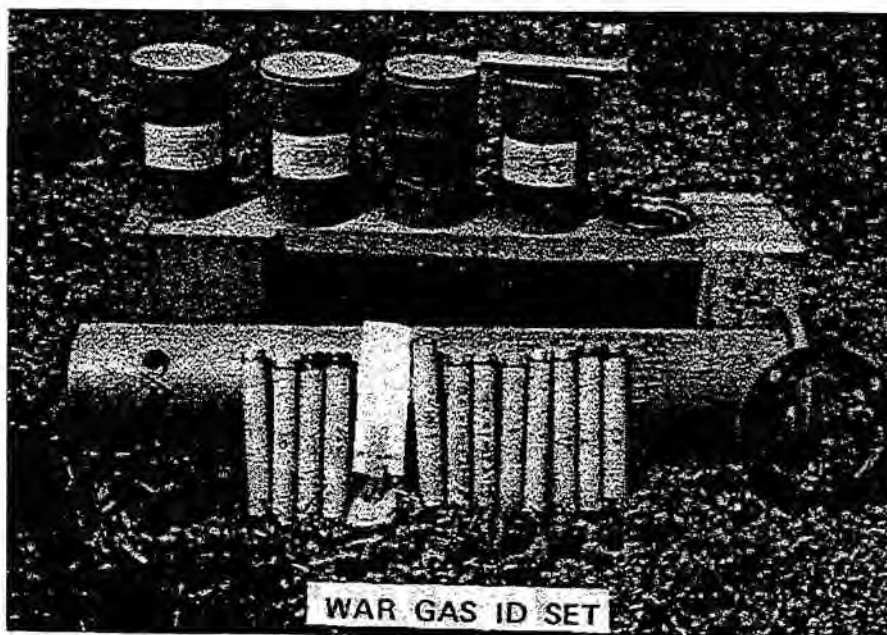
8 Pages from “Doc. No: CLEJ-00253-1.02-10/31/80”

Attachment 2
Historical Aerial Photographs



Attachment 3
Gas Identifier Technical Data Sheets

GAS IDENTIFICATION SET, DETONATION, M1 K951/K952



Use. Designed to be used outdoors. The gas tubes would be detonated, creating an agent cloud. Soldiers would then try to identify the agent based on its odor and other characteristics.

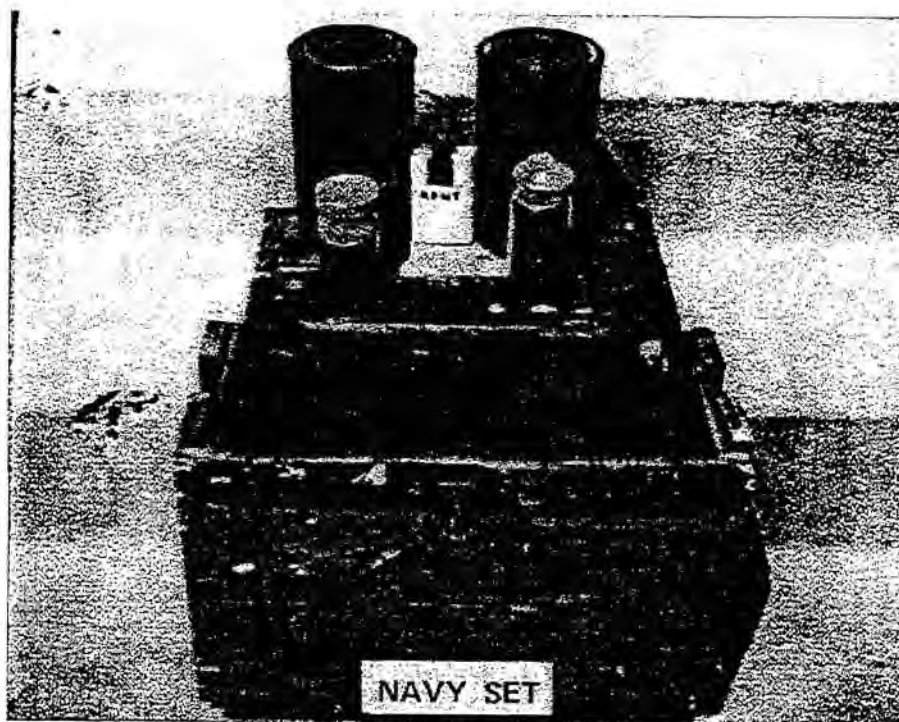
Description. The K951/952 Chemical Agent Identification Set (CAIS) contained 48 Pyrex, flame sealed ampoules, 12 each containing 1.4 ounce solution of Mustard (H, 5% in chloroform) Lewisite (L, 5% in chloroform), Chloropicrin (PS, 50% in chloroform), and Phosgene (CG) for a total of 26 fluid ounces (0.768 liters) of agent, less the chloroform, per set. Each ampoule is 1 inch in diameter and 7½ inches long. Each ampoule is packed in a cardboard screw cap container (mailing tube type) with agent type indicated by letters on the cardboard container. Twelve (12) cardboard containers each are packaged into 4 press fit metal cans which are 9¼ inches high. The cans are packed into a steel cylinder 6⅝ inches in diameter, approximately 38 inches long and 0.145 inches thick. The open end of the cylinder is closed by a flanged end cover which is secured by eight bolts. The only difference between the K951 and K952 is that the K951 was issued with blasting caps that were packed and shipped in a separate container.

Time frame of use Korean Era

Old Stock Number FSN 1365-025-3273 (K951)
FSN 1365-025-3783 (K952)

Reference: *Chemical Agent Identification Set Information Package*, date unknown, U.S.A. Chemical Material Destruction Agency, Aberdeen Proving Ground, Md.

GAS IDENTIFICATION SET, INSTRUCTIONAL M1, (NAVY SET), K955



Use. Designed to be used indoors to instruct military personnel in recognizing the odors of chemical agent. This type of set contains only a small amount of chemical agent.

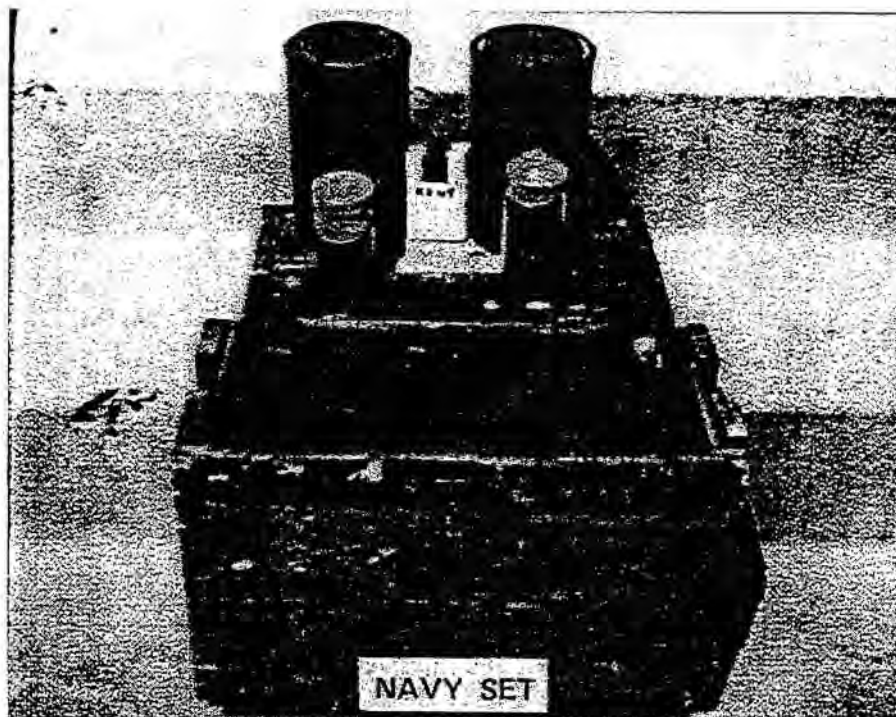
Description. The K955 Chemical Agent Identification Set (CAIS) contains seven glass bottles with a total of 3.5 fluid ounces (0.103 liters) of agent per CAIS. Four of the bottles contain 3 ounces (90cc) of activated charcoal on which agent is absorbed. One bottle contains Lewisite (L), one Chloropicrin (PS), and two Mustard (HS), one contains 6 grams of Triphosgene (a simulant for Phosgene (CG)), one 15 grams of Chloroacetophenone (CN), and one with 15 grams of Adamsite (DM). These sets are packed in a hinged-covered wood box that resembles a foot locker and measures 30 $\frac{3}{8}$ inches wide, 15 $\frac{1}{2}$ inches long and 11 $\frac{3}{4}$ inches high. The inside of the box is divided into eight sections. Seven of the sections contain sealed cans in sawdust and the eighth has instructions. The cans are 4 inches in diameter and 7 inches high and have a paint can type lid. Inside each can is one round bottle with a large screw top or glass stopper which is usually wax coated. The bottles are frequently filled with charcoal.

Old Stock Number FSN 1365-368-6154

Time Frame of Use: Late 1930's to World War II

Reference: *Chemical Agent Identification Set Information Package*, date unknown, U.S.A. Chemical Material Destruction Agency, Aberdeen Proving Ground, Md.

GAS IDENTIFICATION SET, INSTRUCTIONAL M1, (NAVY SET), K955



Use. Designed to be used indoors to instruct military personnel in recognizing the odors of chemical agent. This type of set contains only a small amount of chemical agent.

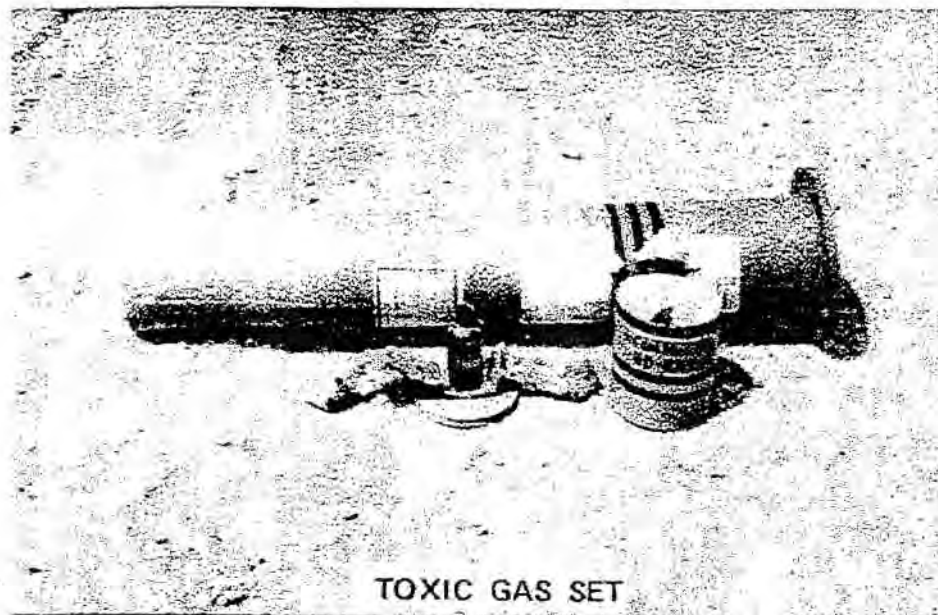
Description. The K955 Chemical Agent Identification Set (CAIS) contains seven glass bottles with a total of 3.5 fluid ounces (0.103 liters) of agent per CAIS. Four of the bottles contain 3 ounces (90cc) of activated charcoal on which agent is absorbed. One bottle contains Lewisite (L), one Chloropicrin (PS), and two Mustard (HS), one contains 6 grams of Triphosgene (a simulant for Phosgene (CG)), one 15 grams of Chloroacetophenone (CN), and one with 15 grams of Adamsite (DM). These sets are packed in a hinged-covered wood box that resembles a foot locker and measures 30³/₈ inches wide, 15¹/₂ inches long and 11³/₄ inches high. The inside of the box is divided into eight sections. Seven of the sections contain sealed cans in sawdust and the eighth has instructions. The cans are 4 inches in diameter and 7 inches high and have a paint can type lid. Inside each can is one round bottle with a large screw top or glass stopper which is usually wax coated. The bottles are frequently filled with charcoal.

Old Stock Number..... FSN 1365-368-6154

Time Frame of Use:..... Late 1930's to World War II

Reference: *Chemical Agent Identification Set Information Package*, date unknown, U.S.A. Chemical Material Destruction Agency, Aberdeen Proving Ground, Md.

TOXIC GAS SET, M1 K941



Description. The K941 CAIS contains 24 glass bottles, each containing 3½ ounces of Mustard (H) or Distilled Mustard (HD) for a total of 84 ounces (2.48 L) per set.

Bottles are round and have a small screw top. Heat resistant paint on the bottles indicates "H", "HS", or "HD", "TOXIC GAS SET, M1". Four bottles are packed in ½ inch layers of sawdust within a sealed metal can. The cans are pressure sealed, 6¼ inches high, and have a sardine-type key on the bottom. Six of these metal cans are fitted into a steel shipping cylinder that is 6⅝ inches in diameter, approximately 38 inches long, and 0.145 inches thick. The open end of this container is closed by a flanged end cover which is secured by eight bolts tightened over a ⅛ inch thick lead gasket.

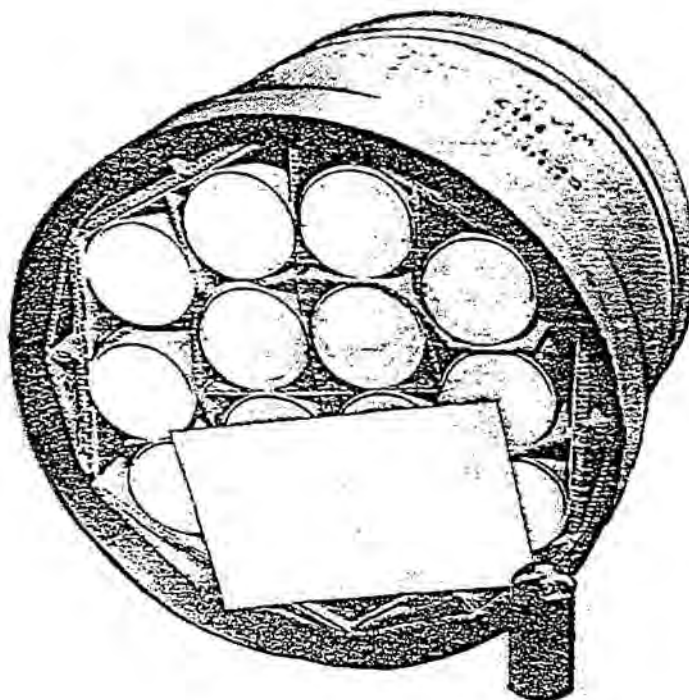
Time frame of use. World War II through the late 1950s.

Old Stock Number..... FSN 1365-219-8574

Reference: *Chemical Agent Identification Set Information Package*, date unknown, U.S.A. Chemical Material Destruction Agency, Aberdeen Proving Ground, Md.

TOXIC GAS SET, M2

K942



Description. The K942 Chemical Agent Identification Set (CAIS) contains 28 heat-sealed ampoules, each containing 3.8 ounces of Mustard (H, HD, or HS) for a total of 106.4 ounces (3.15 Liters) per set. Each ampoule is $1\frac{7}{8}$ inches in diameter and $4\frac{5}{8}$ inches in length and packed in its own can. Twenty eight(28) cans are packed in a cold-rolled carbon steel drum 14 inches in diameter, 14 inches high and 0.0375 inches thick (20 gauge) in 2 layers (14 cans per layer). The cans are separated into individual compartments by fiberboard packaging.

Time frame of use. Korean Era.

Old Stock Number FSN 1365-563-4146

Reference: *Chemical Agent Identification Set Information Package*, date unknown, U.S.A. Chemical Material Destruction Agency, Aberdeen Proving Ground, Md.

Appendix C

Geophysical Investigation Report

GPR
MAGNETICS
ELECTROMAGNETICS
SEISMICS
RESISTIVITY
UTILITY LOCATION
UXO DETECTION
BOREHOLE CAMERA
STAFF SUPPORT

GEOPHYSICAL INVESTIGATION REPORT

**Preliminary Assessment / Site Inspection
Site 69, Rifle Range Chemical Dump and Site UXO-02,
Unnamed Explosives Range
Marine Corps Base (MCB) Camp Lejeune, North Carolina**

Contract Task Order 0223 & 0014

Dates of Investigation:

February 10th – 25th, 2010

FINAL SUBMITTAL
July 13, 2010

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APPENDICES

Appendix A:	GPO Color Contour Maps
Appendix B:	Sample EM31, G858 and EM61-MK2 QC Tests
Contents of CD:	Project Deliverables

ACRONYMS AND ABBREVIATIONS

AHA	Activity Hazard Analysis
CWM	Chemical Warfare Material
DGM	Digital Geophysical Mapping
DQOs	Data Quality Objectives
GPO	Geophysical Prove-Out
GPS	Global Positioning System
MCB	Marine Corps Base
MEC	Munitions and Explosives of Concern
MOA	Master Ordering Agreement
MR	Munitions Response
MRP	Munitions Response Program
mV	Millivolts
NAD83	North American Datum of 1983
QA/QC	Quality Assurance / Quality Control
QC	Quality Control
SI	Site Inspection
SOPs	Standard Operating Procedures
TO	Task Order
UTM	Universal Transverse Mercator

1 INTRODUCTION

NAEVA Geophysics, Inc. was contracted by CH2M HILL to conduct digital geophysical mapping (DGM) from February 10th to the 25th, 2010 at two sites within the Marine Corps Base (MCB) Camp Lejeune, North Carolina. MCB Camp Lejeune is located immediately southeast of the City of Jacksonville, North Carolina. The western and northwestern boundaries are U.S. Route 17 and North Carolina State Route 24, respectively. Site 69 is 14-acre portion of land known as Installation Restoration (IR) Site 69/ Operable Unit (OU) 14 (Rifle Range Chemical Dump) which is located in the Stone Bay area of MCB Camp Lejeune. The site can be accessed through the Stone Bay Entrance located off NC Highway 210 on the southwestern base perimeter. Site UXO-02 is approximately 127 acres in size and includes within it Site 69. The investigation area has gently sloping terrain and is mostly heavily wooded with thick undergrowth.

From 1950 to 1976, Site 69 was reportedly used for the disposal of chemical wastes, including polychlorinated biphenyls, solvents, and pesticides. The Site also has a reported history of chemical warfare material (CWM) disposal in the form of 50 to 60 drums containing mustard or nerve agent. The purpose of the geophysical investigation at Site 69 was to identify potential targets of interest including waste disposal trenches and buried drums. In 1990, a fence was constructed around Site 69 to prevent exposure to potential site contaminants by military personnel performing military exercises in the area. The results of the DGM survey will also be used to confirm that all buried waste, associated with Site 69 is located within the current fence boundary.

The objective of the investigation of UXO-02 was to attempt to locate anomalies potentially representing Munitions and Explosives of Concern (MEC) resulting from the historic range activities. No MEC was reported on the surface of the site. Prior to the start of mapping at both sites, a Geophysical Prove-Out (GPO) was completed for the purpose of documenting the acceptable performance of equipment and personnel and establishing an appropriate anomaly targeting threshold.

2 METHODS

Professional land surveyors were contracted by CH2M HILL to install survey points along predetermined transects to allow NAEVA to reference fiducial markers used during the DGM survey. Transects, generally parallel and in a roughly north-south orientation, were identified with stakes spaced approximately 20-30 meters apart (depending on terrain). A Geonics EM31 and a Geometrics G-858 Magnetometer were used to map the GPO and transects for Site 69. A Geonics EM61-MK2 was used to map the GPO and transects throughout UXO-02. The EM61-MK2 mounted on wheels was used to collect data in local coordinates due to tree canopy.

Transects would be placed throughout the site approximately 10 feet apart which would allow adequate coverage with both the EM31 and the magnetometer to identify buried waste material. Transects were also placed outside of the fenced area in order to confirm the current fence configuration encompassed all to the buried waste associated with Site 69.

Each transect in UXO-02 was covered by two data passes approximately 5 feet apart, named (T)-1 and (T)-2 respectively (where T is the transect number). The DGM of each transect was accomplished by collecting (T)-1 in one direction and returning along (T)-2 in the opposite direction.

The survey stakes used to identify the transects for both sites were also used to position the data sets. While collecting, fiducial marks were placed in the data whenever a stake was crossed. Using these marks, the data could then be accurately positioned along these transects. Locations for these stakes were recorded in UTM's by the surveyor and were then used by NAEVA during data processing to transform the geophysical data from a local coordinate system to geodetic coordinates.

All daily logs, field notes, and sketches were input digitally into a Palm TREO PDA. At the end of each day, this information was uploaded to the project database for use in preprocessing the geophysical data.

2.1 Geonics EM31 Terrain Conductivity Meter

The EM-31 consists of a transmitter coil mounted at one end and a receiver coil mounted at the other end of a 3.7-meter long plastic boom. Electrical conductivity and in-phase field strength are measured simultaneously and stored along with line and station numbers in a digital data logger. The in-phase component is primarily used in searching for buried metal, measuring in units of relative parts per thousand (ppt) of the primary magnetic field. A negative response is most often observed over areas of shallow buried metal debris. The quadrature-phase measures electrical conductivity in milliSiemens per meter. Electrical conductivity is a function of porosity, conductivity of included soil moisture or contaminants, degree of saturation, and the type of soil and rock. The absolute values of terrain conductivity are not diagnostic, but their spatial variations are important; permitting identification of lateral changes in the shallow subsurface conditions. For this survey the EM31 was operated in vertical dipole mode. The vertical dipole mode has very low sensitivity to near surface materials. The sensitivity then increases with depth, becomes a maximum and then falls away beyond that depth. In the horizontal dipole mode the relative sensitivity is greatest to material at the near surface and then decreases with depth. This means that deeper anomalies are detected in the vertical mode and shallow anomalies in the horizontal orientation. The EM31, in vertical dipole mode, has the greatest portion of response affected by material in the 3-9 foot depth range but can provide information to a maximum of approximately 18 feet. Data were collected in automatic mode, at a rate of 5 readings per second.

2.2 Geometrics G-858 Cesium Vapor Magnetometer

A Geometrics G-858 total field magnetometer, operated in vertical gradient mode, was employed for the magnetics survey. The G-858 system comprises a belt-mounted display/logging console connected to two cesium sensors mounted one directly on top of the other on a handheld counterbalanced staff. The console contains electronics to acquire magnetic field data with position and display it on an LCD screen for review and edit. The use of vertical gradient mode (two vertically-separated sensors operating simultaneously), eliminated the need for a magnetics base

station. Ferrous material typically manifests a remnant magnetic field that varies in orientation from that of the Earth's magnetic field. The summation of the remnant field to the Earth's field results in distortions in the overall field. These local, high frequency (short wavelength) anomalies in the Earth's magnetic field can therefore be interpreted as being caused by subsurface ferrous material. Magnetism data were collected at a rate of 10 readings per second.

2.3 Geonics EM61-MK2 Electromagnetic Metal Detector

The EM61-MK2 is a time-domain electromagnetic (EM) instrument designed to detect, with high spatial resolution, shallow ferrous and non-ferrous metallic objects. The applicability of the instrument for MEC detection has been widely demonstrated. The instrument consists of one air-cored coil (1 m x 0.5 m), batteries, processing electronics, and a digital data recorder. The secondary coil is used for collection of data in differential mode. While differential mode has been known to allow the detection of depth of large anomalies (tanks, utilities, etc.), it has not been proven accurate for MEC applications. The primary function of the coil is as an EM transmitter and receiver. Secondary currents induced in the coil are measured in millivolts (mV). For this survey, the EM61-MK2 was set up to collect data with 4 time gates (Channels) from the bottom coil which are geometrically spaced in time after the termination of the transmitter pulse. Based on results from numerous projects on Camp Lejeune and completion of the GPO's have set the threshold at 3mV in channel 2.

The EM61-MK2 was operated in fiducial mode with the bottom coil mounted on manufacturer-supplied wheels, 40 cm above the ground surface recording a reading every 10 centimeters. The EM61-MK2 data were recorded with an Allegro CX data logger.

3 GEOPHYSICAL PROVE-OUT (GPO)

The purpose of surveying a GPO is to demonstrate the effectiveness of all instrumentation, methods, and personnel prior to the initiation of fieldwork. Serial number identifications were recorded for all instrumentation (i.e. data loggers,

sensors and system electronics), and the GPO was mapped using the same personnel, equipment, and methodologies employed for the DGM surveys.

The GPO, located just north of the intersection of Toledo Road and Camp Knox Road, was collected on February 9th, 2010. Its dimensions are approximately 12 meters by 20 meters. The GPO was mapped with fiducial markers entered into the data every 10 meters. The GPO was collected using both the EM61-MK2 and the G-858 magnetometer. The EM61-MK2 collection was performed with survey lines spaced 0.75 meters apart. This spacing results in coil overlap on successive lines, reducing the likelihood of data gaps and improving the chance of detecting small MEC items. The GPO had been seeded for previous work, so a background survey was not performed. The G-858 magnetometer GPO implemented a transect-like survey with each line spaced 1.5 meters apart. This was deemed acceptable by CH2M HILL's on-site representatives for use as the prove-out. A daily instrument verification strip (IVS) was collected in order to verify proper instrument function following completion of GPO.

The EM31 was not demonstrated in the GPO due to the instrument's limited capabilities in detecting small metallic items. Instead, a dynamic test was run over a large metallic item (in this case a manhole cover) in order to demonstrate that the instrument was working correctly.

Magnetics data and data from Channel 2 of the EM61-MK2 were processed and used to generate final target selections in the GPO as well as in the field area. Color contour maps of the data from the surveys of the GPO are included in Appendix A. The results were reviewed by the QC Geophysicist and showed good correlation to previous surveys of the same GPO. After the QC review, the GPO results were provided to CH2M HILL for final approval.

4 FIELD DATA ACQUISITION

From February 10th through the 25th, a total of 204 transects for Site 69 and 130 transects for UXO-02 were mapped. Transects were previously cleared of vegetation to allow for access to perform geophysical surveys. Survey points were then placed

within the lanes at 20 - 30 meter increments by a professional land surveyor. A survey point was placed at the start and end of each transect and whenever the transect changed direction to follow the cleared path. Survey points were also placed on both sides of obstructions intersecting the transect, providing for appropriate stop and start points and avoiding excessive data gaps.

Prior to collection, initial QC tests were performed for each instrument following daily instrument calibration in accordance with the manufacturer's specifications, as described in Section 5.1. G-858 magnetometer, EM31, and EM61-MK2 QC tests consisted of static tests with a standard response item, cable shake tests, and personnel tests. Dynamic tests were performed for each of the instruments in order to confirm proper functionality. The EM31 test consisted of surveying a circular metal lid while the EM61-MK2 and G-858 magnetometer tests consisted of surveying an IVS line. The QC static tests for each instrument were done before, between, and after collection of separate grid blocks. The dynamic test was done at the beginning and end of each day to record responses and correct for drift throughout the day.

Data were collected first at Site 69 with both the EM31 and the magnetometer. Due to the size of the site the field team was split up for simultaneous collection in order to maximize efficiency. In order to minimize the effect of one instrument upon the other, a minimum distance of 15 transects (150 feet) was maintained between instruments.

The site, being irregularly shaped and partially inside a fence, was divided into three areas; IF (inside fence), OF (outside fence) and OFN (outside fence north). The total acreage collected for Site 69_IF was approximately 5.42 acres spread over 123 transects, Site 69_OF measured 2.54 acres collected across 98 transects, and Site 69_OFN totaled 1.05 acres collected over 83 transects.

Due to the size of the site and the presence of wetlands located in the middle of the area, UXO-02 was divided into four sections. Section 1 was located to the northeast, Section 2 composed the middle, Section 3 was located to the west, and Section 4 was the southernmost portion. The presence of wetland areas reduced the available survey area; therefore, the distance between transects were changed from

approximately 25m apart to 7m in order to cover the acreage specified in the Scope of Work.

UXO-02 Section 1, located to the northeast, had a total of 20 two-pass transects. Approximately 1.35 acres of data were collected in this area. These transects ranged greatly in length due to swampy conditions located both to the north and to east. The western border of Section 1 was a road running alongside a fence. This road made easy access to Section 1 and allowed the field crew to collect the transects from south to north. Numerous transects were bisected by swampland to the east, diminishing the continuous coverage in the area. Additional transects were created in order to compensate for this loss of coverage.

Section 2, located in the middle of the site, is covered by 37 two-pass transects totaling approximately 3.10 acres. Stones Bay creates the eastern boundary for this section, while Site 69 provides the western boundary. Wetland areas occupy both the northern and southern boundaries. The transects gradually increase in length as the collectable area increases in size to the east. The general conditions of this section were predominately flat areas with a few slopes relating to the inlets from Stones Bay. A road surrounding Site 69 provided access to this section and favors collection from north to south. Large trees were often found lying across transects, creating data gaps.

Section 3, to the west, covered 4.15 acres over 36 two-pass transects. This section was bounded by a road to the west, Site 69 and a road to the north and an inlet from Stones Bay to the east. Standing water from the inlet stretches its way throughout Section 3 creating a series of gaps that could not be cleared of brush. This section was generally flat with gentle slopes related to the inlet. A number of downed trees were noted on the transects and were carefully traversed in order to maintain the appropriate data density. The section was collected from the north to the south due to roads surrounding the area. As a result of a wetland bisecting the area, collection took place in two stages. First, the northern portion of the area was collected, followed by the southern.

Section 4, which includes 37 two-pass transects, covers 2.68 acres. Much like

Sections 2 and 3, this area was flat with isolated slopes relating to the inlet from Stones Bay to the north. The amount of wetland related to the inlet on transects was minimal with the large gaps being created by steep slopes along which the brush crews could not navigate. A road formed a portion of the southern border of Section 4 with Stones Bay bounding it to the east. Large trees were relatively spread out compared to the rest of the site thus reducing the number of obstacles on the transects. With the road lying along the southern boundary, collection was performed starting on the southern end proceeding north.

5 QUALITY CONTROL DATA

To establish confidence in the data reliability, Quality Control (QC) tests were conducted throughout the project. Tests were conducted prior to, during, and after all data collection sessions. All QC tests for all instruments were conducted after a minimum 10-minute warm-up period for the electronics. Sample graphical displays of QC data are included in Appendix B. All quality control data are included on the enclosed CD.

5.1 QC Test Descriptions and Acceptance Criteria

Personnel Test: A personnel test was conducted each day with the coil in a stationary position. The test included briefly logging background response and then the response while one team member operated the equipment and the other walked in the vicinity of the coil. The objective was to demonstrate that clothing or objects carried by personnel had no effect on instrument response.

Cable Shake Test: Prior to beginning data collection each day, data were recorded with the coil held in a stationary position, and the cables and connections were tested for possible shorts by shaking them. The operator monitored the response for any spikes during the process.

Static Background / Spike Test: A location identified as having minimal background response was designated as a calibration point. Readings were collected in a stationary position to ensure a stable response. Data were collected for a period of one minute with no object placed below the coil. An Industry Standard Object

(ISO), attached 42 cm above a wooden board, was then placed on top of the coil. Data were recorded for one minute with the object in place. The item was then removed, and static readings continued for an additional minute. This test was performed at the beginning, between data sets, and end of each day to establish that the instrument was functioning properly, as indicated by a stable and repeatable response with no spikes or other anomalous activity. A response of $\pm 20\%$ after background correction was acceptable.

IVS Line: Following the morning static test for both the EM61-MK2 and G-858, a single line was collected over an Instrument Verification Strip (IVS). This test was used to document the repeatable responses of known objects at known depths.

Dynamic Test: The Dynamic test was used for the EM31 due to the lack of sensitivity to small metallic items. A single line was collected over a large metallic item in order to record a significant response and ensure proper functionality.

Repeat Data: This test was performed to verify the repeatability of the data and was performed at the end of each grid block. At least 2% of the survey lines were repeated and evaluated for consistency. Since small deviations in line path can affect the instrument response the profiles were evaluated qualitatively. The spike test is used to assess quantitative repeatability.

5.2 QC Test Results

QC data were evaluated using Geosoft's QA/QC software. Static, spike, cable shake, and personnel test profiles were plotted with an acceptance criterion of ± 2 mV from the mean. Any readings outside this range were flagged on the profiles, and an associated failure percentage was reported.

Personnel Test: No deviation from background response was observed.

Cable Shake Test: No spikes were observed in any of the tests.

Static Background / Spike Test: All static and spike tests were well within acceptance criteria; stable, repeatable, and without spikes.

IVS Test: IVS tests were plotted showing the line path and gridded response. A comparison of tests shows that response amplitudes are consistent and test item

positions are accurate.

Dynamic test: Daily comparisons of tests showed that response amplitudes were consistent and test item positions were accurate.

Repeat Data: Repeat lines showed repeatability within the acceptance criteria.

6 DATA PROCESSING

EM31 data were temporarily stored in an Allegro CX data logger using Geonics EM31CX software version 1.18 and then downloaded into a laptop computer for further on-site processing using Geonics DAT31 version 2.07. G-858 magnetometer data were stored on the instrument console and then transferred to a laptop computer for processing through MagMap 2000 version 4.88. EM61-MK2 data were temporarily stored in an Allegro CX data logger using Geonics' EM61-MK2 software and then downloaded into a laptop computer for further on-site processing using Geonics' DAT61MK2 version 2.37. Initial data processing was performed by the field team. This included reviewing data for integrity and repeatability and positioning the data based on the local distance from the first stake on each transect.

Once in-field review was completed, the data were transferred to NAEVA's Charlottesville, Virginia office for preprocessing, analysis/target selection, and final map production using Geosoft's Oasis Montaj software version 7.1.1.

6.1 Preprocessing

Converted raw data files were imported into Geosoft's Oasis Montaj to perform the following:

- Review and finalize all QC tests (cable shake, personnel, and static) prior to processing DGM data for that day;
- Conversion of raw coordinates to projected NAD83 UTM Zone 18N coordinates using meters;
- Evaluation of data density;
- Application of auto leveling and instrument drift corrections for EM61-MK2 data;
- Application of default lag correction;
- Generation of preliminary contour map(s) from gridded data;
- Generation of preliminary original versus repeat profiles by grid block;
- Generation of formatted ASCII files containing preprocessed data by grid

block.

Coordinate conversion from raw to projected coordinates was accomplished by matching fiducial marker locations with surveyed control points provided by a licensed land surveyor; this method was used for all three geophysical systems.

6.2 Final Processing

After completion of preprocessing, the data were further evaluated and processed to generate final processed data files. Final processing steps included:

- Evaluation and refinement of auto leveling and instrument drift corrections for EM61-MK2;
- Application of heading correction to magnetic data, if needed;
- De-spiking of magnetic data, if needed;
- Evaluation and refinement of lag correction;
- Additional digital filtering and enhancement, as necessary;
- Targeting of data, as described below;
- Generation of formatted ASCII files containing processed data by grid block;
- Generation of final maps for each grid or block showing contoured, gridded data, target locations, areas of interest and culture;
- Generation of final original versus repeat profiles by grid block.

For the EM31, final processing was performed on both the inphase and terrain conductivity (quadrature) measurements. The G-858 magnetometer total field data from the top and bottom sensors was despiked as needed and if necessary the vertical gradient recalculated. All other corrections and processing steps were applied to the vertical gradient data. All final processing steps were applied to Channel 2 of the EM61-MK2.

6.3 Analysis and Target Selection

Final processed XYZ (ASCII) files and geophysical contour maps were created for the Site 69 and UXO-02 surveys. All raw and processed data can be found on the enclosed CD.

6.3.1 Site 69 EM31 Potential Areas of Interest

Since no individual targets were selected for the EM31, potential areas of interest were identified in both the conductivity and inphase components. A composite image of all data collected at the site and known cultural features was used for data interpretation. Areas showing distinct deviations from background values were

outlined and identified as areas of interest on Plates 1 & 2.

6.3.2 Site 69 Magnetism Potential Areas of Interest and Target Selection

The primary objective of the investigation was to identify metallic anomalies that may be related to previously buried chemical waste. This was accomplished using a composite image of all vertical gradient data collected at the site and known cultural features. Potential areas of interest were identified around spatially large anomalous features likely to represent large concentrations of subsurface metal on Plate 3.

The secondary objective was to use the magnetism data to identify smaller anomalies that potentially represent MEC. The vertical gradient profile data was analyzed by a trained geophysicist and targeted by selecting apparent local anomalous features that likely represent point-source anomalies. Prior to target selection, a digital filter was used to capture local minimum and maximum values in the vertical gradient response associated with the peak and trough values for dipole anomalies. During target selection, the selected target location and associated vertical gradient, local minimum and local maximum were all recorded. Target locations were placed at the inversion point for dipole features and positive or negative peak location for monopoles. A “magnitude” channel was calculated for each target that represents the range of response across the anomaly; the maximum minus the minimum. All target selections were performed on final processed vertical gradient data from the G-858 magnetometer.

6.3.3 UXO-02 EM61-MK2 Target Selection

The UX-Detect module within Oasis Montaj identifies peak amplitude responses associated with, but not limited to, MEC items. Single-source anomalies may generate multiple target designations depending on shape and orientation. Initial target selections were auto-selected using a peak picking algorithm based on the Channel 2 profile data. Data profiles corresponding to the anomalies selected by Geosoft were then analyzed by trained geophysicists, with the targets evaluated as to their validity and position. Targets found to be invalid or incorrectly located were removed or adjusted. Additionally, anomalies that were not selected by the UX-Detect module, yet deemed to represent potential MEC targets, were manually

selected. All anomalies that occurred at or above the targeting threshold of 3 mV were identified using an ID number. All targets were selected from final processed Channel 2 data of the EM61-MK2 bottom coil.

6.4 Deliverables

Final processed XYZ (ASCII) files for Site 69 and UXO-02 were created by block, and individual target lists were created for each transect. Each target list provides a Target ID, Transect ID, Easting (x) and Northing (y) UTM coordinate location for each target, and the recorded peak response in instrument units. The target IDs were assigned by numbering the targets with increasing IDs starting from south end of each transect. In addition, some targets were assigned a type, a numerical value with “4” representing known culture, “5” for probable noise/data spikes, and “6” representing suspected culture.

All target lists and both raw and processed data have been submitted to CH2M HILL’s geophysicist and can be found on the attached CD. Also included are processing reports, a copy of the MRSIMS database, and target lists in MRSIMS format.

7 RESULTS OF SITE 69

The geophysical data collected at Site 69 as displayed on Plates 1, 2 & 3 show the localized subsurface metallic concentrations across the site. The area inside the fence has the greatest likelihood of containing drums and other large metallic items indicative of trenching. Large anomalies are present in the south-central portion of the survey area surrounding numerous monitoring wells. Areas outside of the fenced area to the north and east are relatively clean in comparison.

EM31 terrain conductivity data (Plate 1) shows significant anomalies located on the southern margin of the site, likely indicative of landfill material. AOI 1 is likely a result of an increase in subsurface saturation, either from ground water, contaminate liquid, or both. Standing water in this area may also contribute to this change in conductivity. AOI 2 and 3 have similar responses to the large anomaly previously mentioned. Yet, these anomalies had no surface indications of saturation and may

warrant further investigation. Elevated responses can also be observed near the edges of the surveyed area outside the fence. These responses are probably related to standing water observed in the area from Stones Bay inlet.

The in-phase data (Plate 2) collected with the EM31 correlates well with the conductivity data. The response of AOI 1 and 2 is related to the monitoring wells. AOI's 3, 4, 5 and 6, however, are not associated with monitoring wells. Similar sizes and locations of major anomalies are apparent within the fence line. AOI's 1 and 2 from the conductivity map and AOI's 2, 3 and 4 from the in-phase show very good correlation. Both these sets of data show a reverse "L" shape trend located in the middle of the fenced in area.

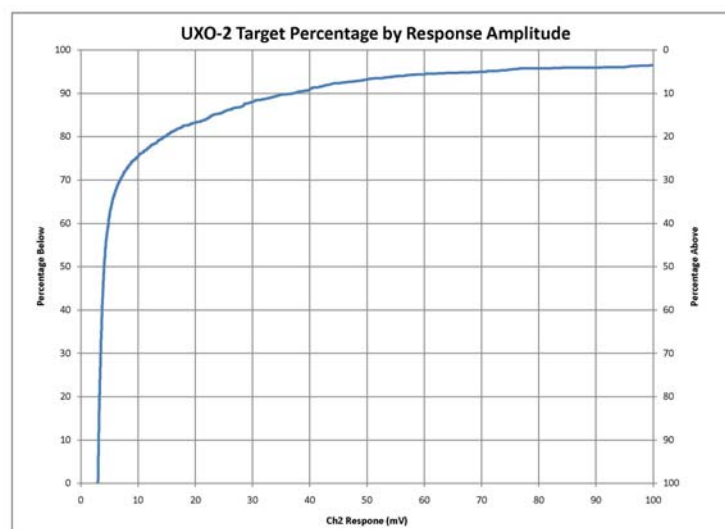
Some differences were detected between the in-phase and conductivity data. The large conductivity anomaly AOI 3 is observed without a corresponding in-phase anomaly. This feature is likely due to a subsurface change in the ground composition resulting in a change in subsurface conductivity. Likewise, the in-phase anomalies AOI 5 and AOI 6 are located inside the fence to the north and have no conductivity counterpart. Most likely the result of individual buried metallic items.

The magnetometer data (Plate 3) confirms the presence of widespread anomalous response throughout the southern portion of the site. The G858 is more sensitive to smaller quantities of ferrous metal than the EM31, and as a result the area of landfill debris for Site 69 appears larger than what is evident in the EM31 data (Plate 3). A total of 847 point targets were selected within Site 69. These targets are shown in more detail on their block maps located on the CD attached. AOI 2 has linear, high-response patterns within the suspected burial area which is a good indicator of trenching activities. Some of this response is likely due to debris that is either visible at the surface or in the shallow subsurface. A number of magnetic anomalies appear throughout the site that are not seen in the EM31 data sets. Most of these can be explained by their proximity to monitoring wells. AOI's 1, 3, 4, 5, 6 and 7, however, have no surface indicators to explain their presence. These anomalies appear to be the result of small, isolated pieces of ferrous metal rather than extensive landfill material.

The anomalous areas show similar trends among all three maps (Plates 1, 2, & 3) which confirm the locations of the contamination. Several smaller anomalies spread throughout the fenced area are likely independent burials, distinct from the main feature located in the area's center.

8 RESULTS OF UXO-02

Within UXO-02, 1,457 targets were selected at a threshold of 3 mV in Channel 2: 273 targets in Section 1 (Plate 4), 369 targets in Section 2 (Plate 5), 515 targets in Section 3 (Plate 6), and 300 targets in Section 4 (Plate 7). In general, targets were evenly distributed throughout the site. Throughout UXO-02 the response values for any given section were generally below 10 mV. Among the 1,457 targets selected in UXO-02 a number of them were determined to be culture or noise. There were 69 Type 4 anomalies which represent known culture, 205 Type 5 anomalies which are suspected noise, and 34 Type 6 anomalies which are suspected culture. These three types of anomalies account for approximately 21% of the total targets selected. The total number of targets correlates directly with the size of the section collected. Within each section, an area could be identified in which an increase in target density occurred. The graph below shows target selection as a function of response amplitude. This illustrates the amount of targets that would be selected should the mV threshold change. For example, if the threshold was changed to 10 mV, the percentage of targets eliminated would be 75%.



Section 1 contains the smallest acreage covered with the lowest number of targets selected (Plate 4). Approximately two-thirds of the targets are located in the northern half of the collection area. Of these, the majority are concentrated to the east in a low-lying area near the wetlands. This could be a result of trash/debris flowing downstream or from military activity in Stones Bay washing inland during times of elevated water levels.

Section 2 (Plate 5) has a relatively even distribution of targets throughout the area compared to Section 1. A slight increase in density is evident within the middle portion of the area. Unlike Section 1, transects near the water's edge were relatively clean compared to the rest of the area. This could be due to the topography of this section. Cliffs as high as 40 feet mark the eastern edge of this section which then drops off again to the west. This change in elevation creates a valley which would tend to trap metallic items from military exercises from entering the bay due to the surrounding highlands.

Section 3 (Plate 6) of UXO-02 has the largest acreage covered and consequently the most targets selected. This area has numerous wetlands and gaps related to water stretching inland from Stones Bay. The majority of the targets are not associated with the drainage to the wetland boundary but rather the roads that create the northern and western boundaries. The northern boundary is the main access road for UXO-02 and Site 69. An increase in targets is also observed along the fence line of Site 69. The increase in density could likely be related to road traffic and associated debris.

Section 4 (Plate 7) has the greatest concentration of targets to the east, near the water. A large response area with multiple targets is observed on the eastern portion of the site. This anomaly grouping appears to be related to a localized trash site. A metallic drum was observed on the surface in this area.

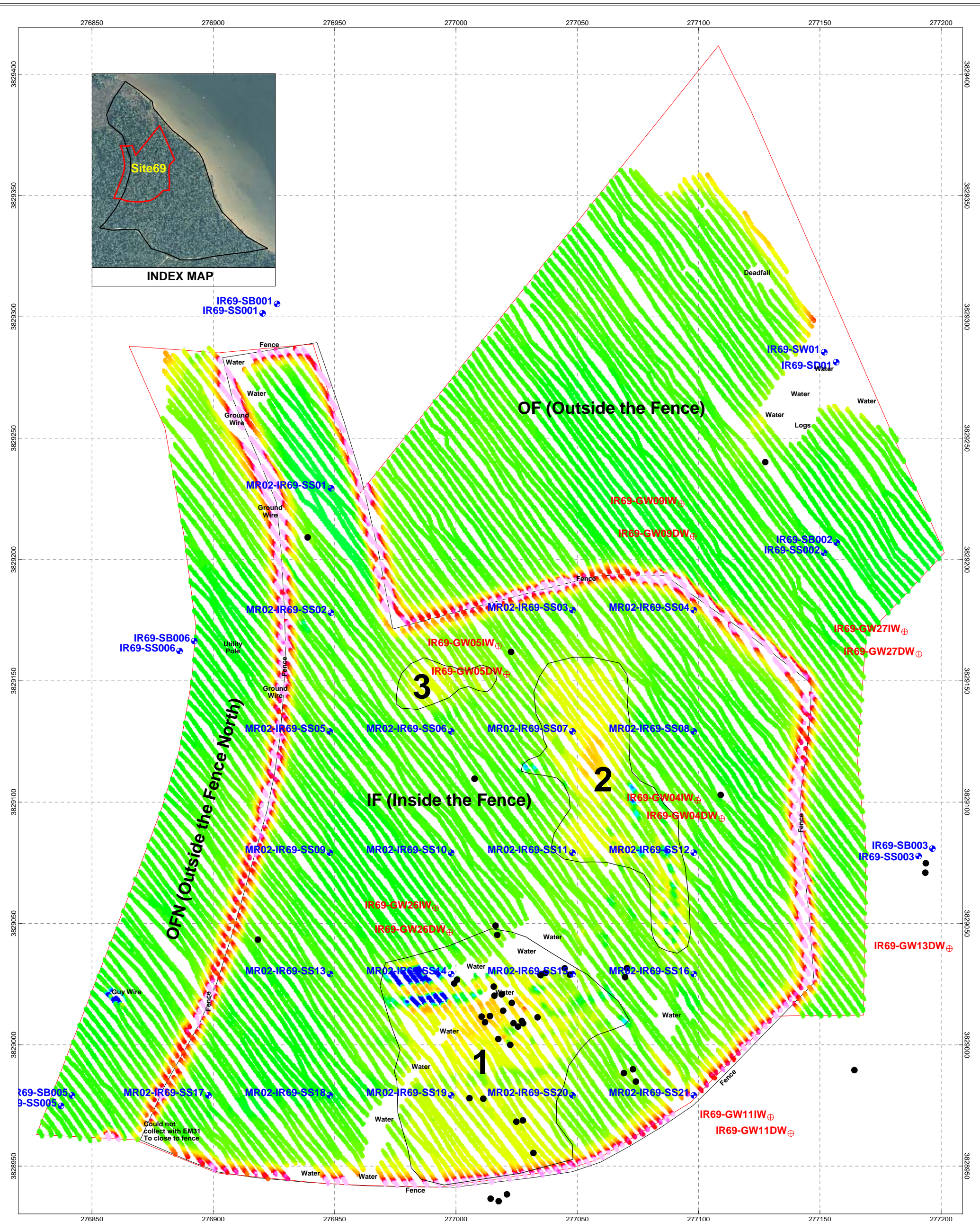
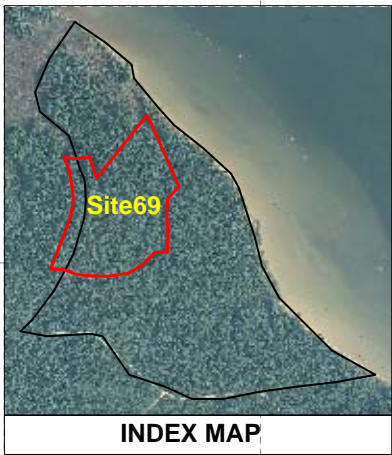
REFERENCES

CH2M HILL, 2007. Munitions Response Master Project Plan, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina. July 2007.

CH2M HILL. 2009d. Draft Geophysical Investigation Plan, Rifle Range Chemical Dump (Operable Unit 14, Site 69), Marine Corps Base Camp Lejeune, Jacksonville, North Carolina. February 2009.

CH2M HILL, 2009. Site Specific Work Plan Addendum for Preliminary Assessment/Site Inspection Site UXO-02, Unnamed Explosives Range, ASR #2.201, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina. November 2009.

PLATES



Subsurface Geophysical Surveys

Legend

- Culture (if noted) Locations recorded with a 3 to 5 meter accuracy GPS
- ⊕ Proposed MW
- ⊕ Proposed Sample
- ⊕ Potential Area of Interest (AOI)

mS/m

-5 -3 -1 1 2 3 4 5 6 7 8 9 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54

10 0 10 20 30 40 50 (meters)

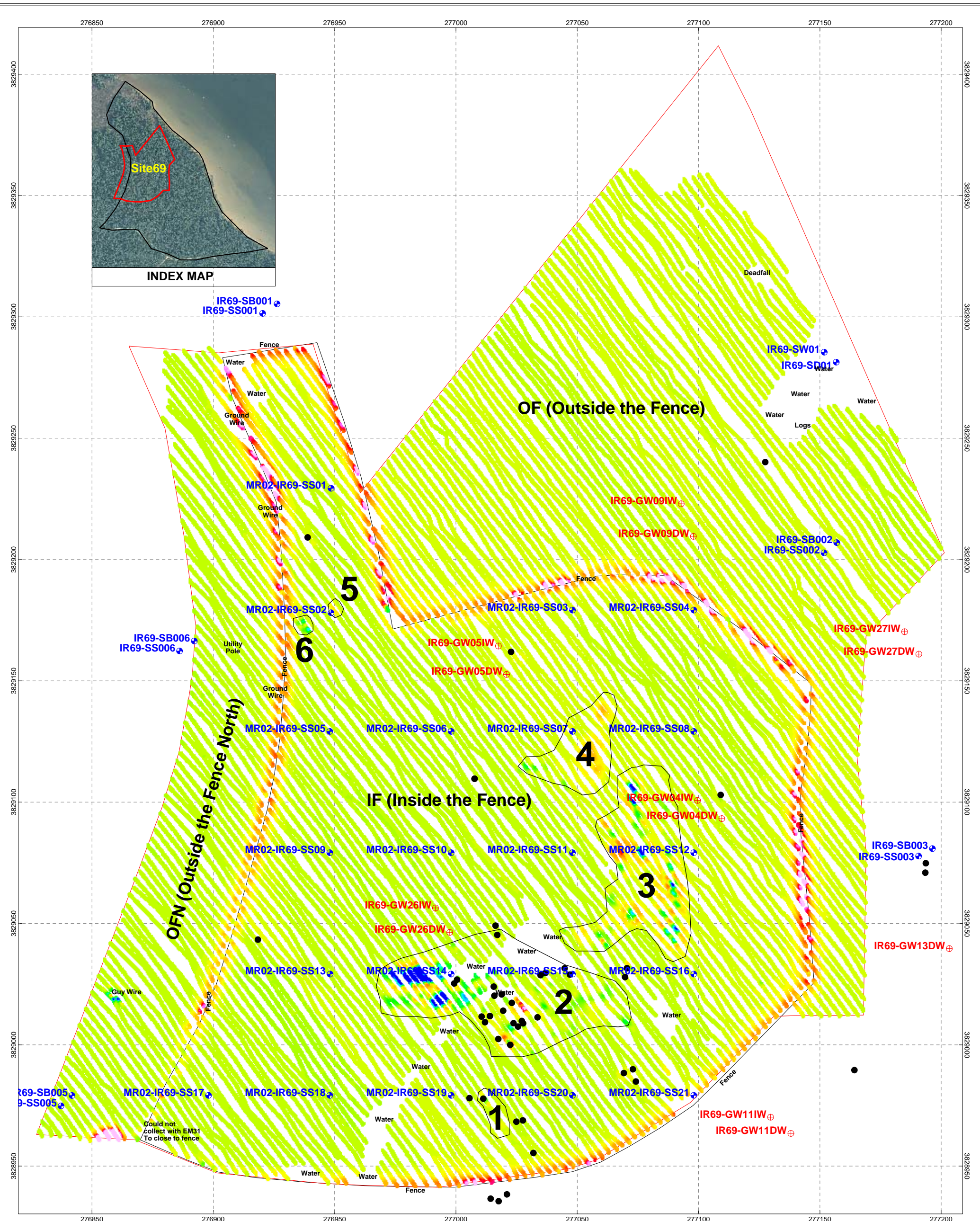
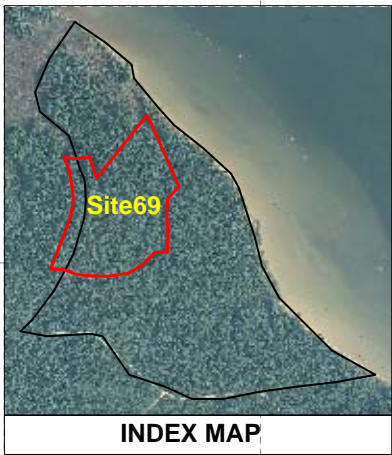
NAD83 / UTM zone 18N

Plate 1

Client: CH2M HILL

EM31 Conductivity
Site Mosaic
Site 69
Marine Corps Base, Camp Lejeune
Jacksonville, North Carolina

Date of Survey: 02/11/2010 - 02/19/2010
Date of Map Creation: 03/03/2010
Map Approver: J. Gullard



Subsurface Geophysical Surveys

Legend

- Culture (if noted) Locations recorded with a 3 to 5 meter accuracy GPS
- ⊕ Proposed MW
- ⊕ Proposed Sample
- ⬠ Potential Area of Interest (AOI)

ppt

-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

10 0 10 20 30 40 50 (meters)

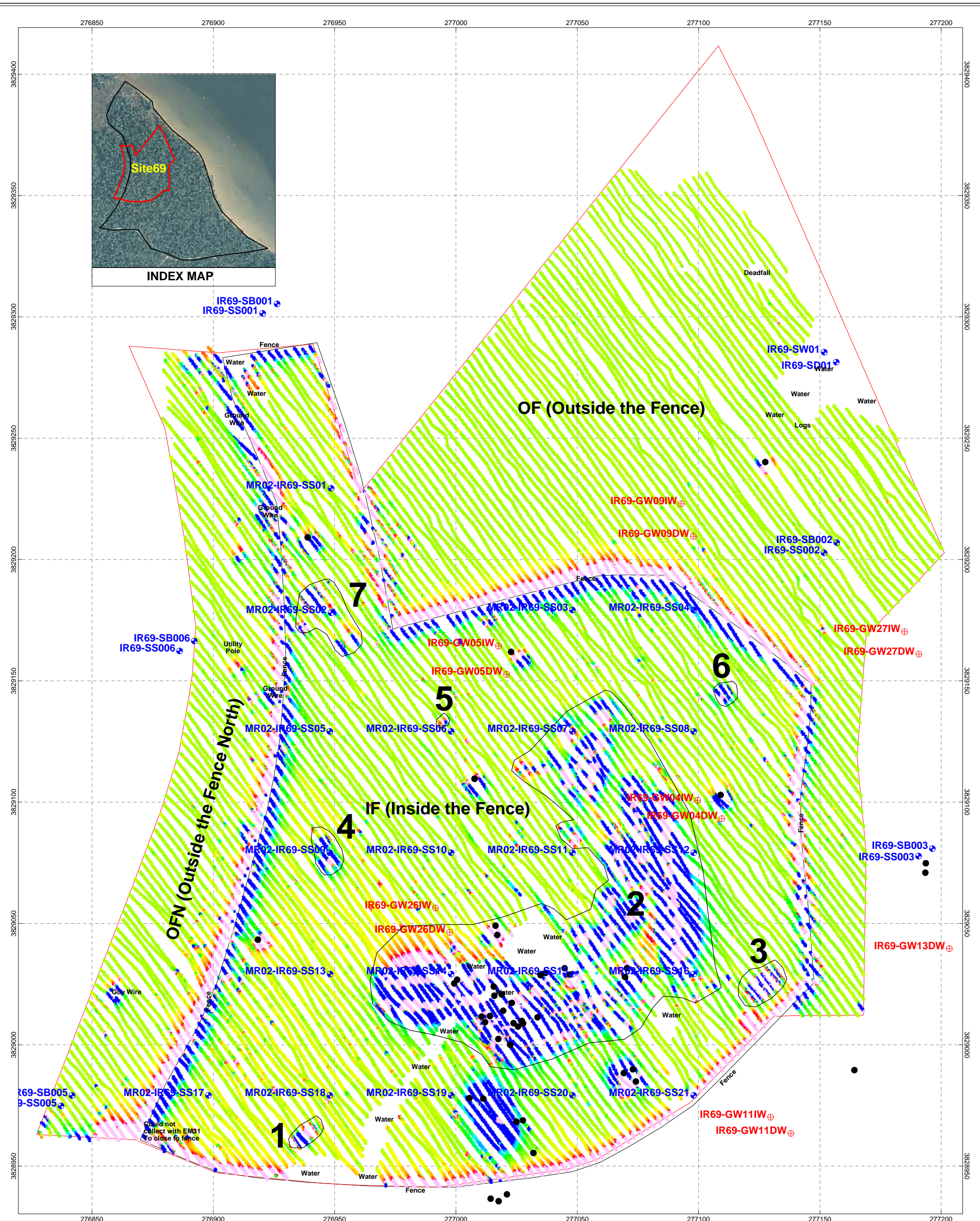
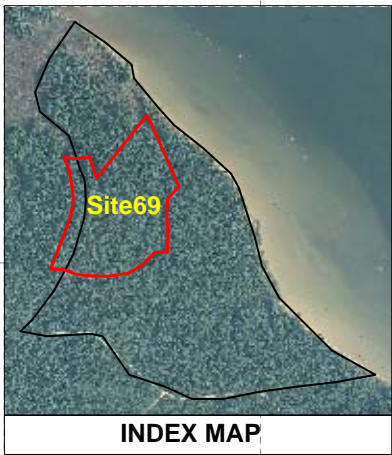
NAD83 / UTM zone 18N

Plate 2

Client: CH2M HILL

EM31 Inphase
Site Mosaic
Site 69
Marine Corps Base, Camp Lejeune
Jacksonville, North Carolina

Date of Survey: 02/11/2010 - 02/19/2010
Date of Map Creation: 03/03/2010
Map Approver: J. Gullard



NAEVA GEOPHYSICS INC.
Subsurface Geophysical Surveys

Legend

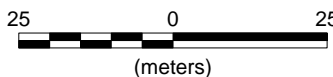
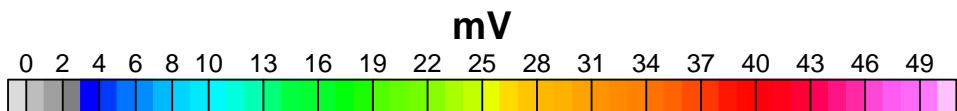
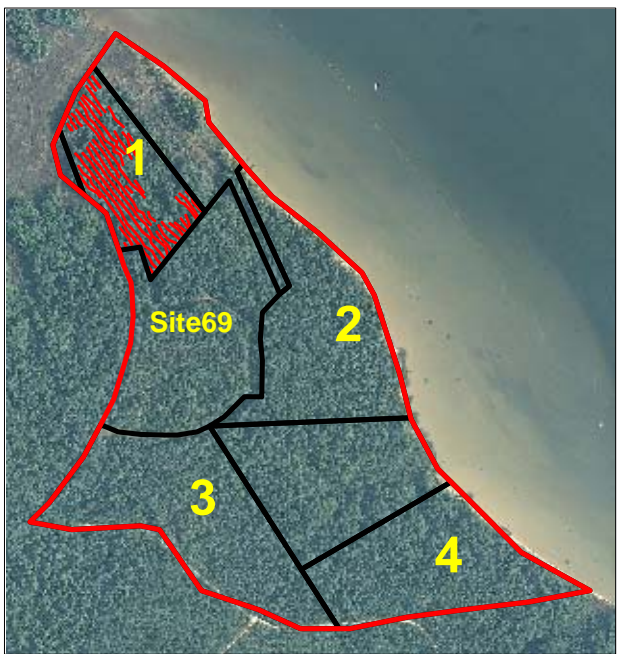
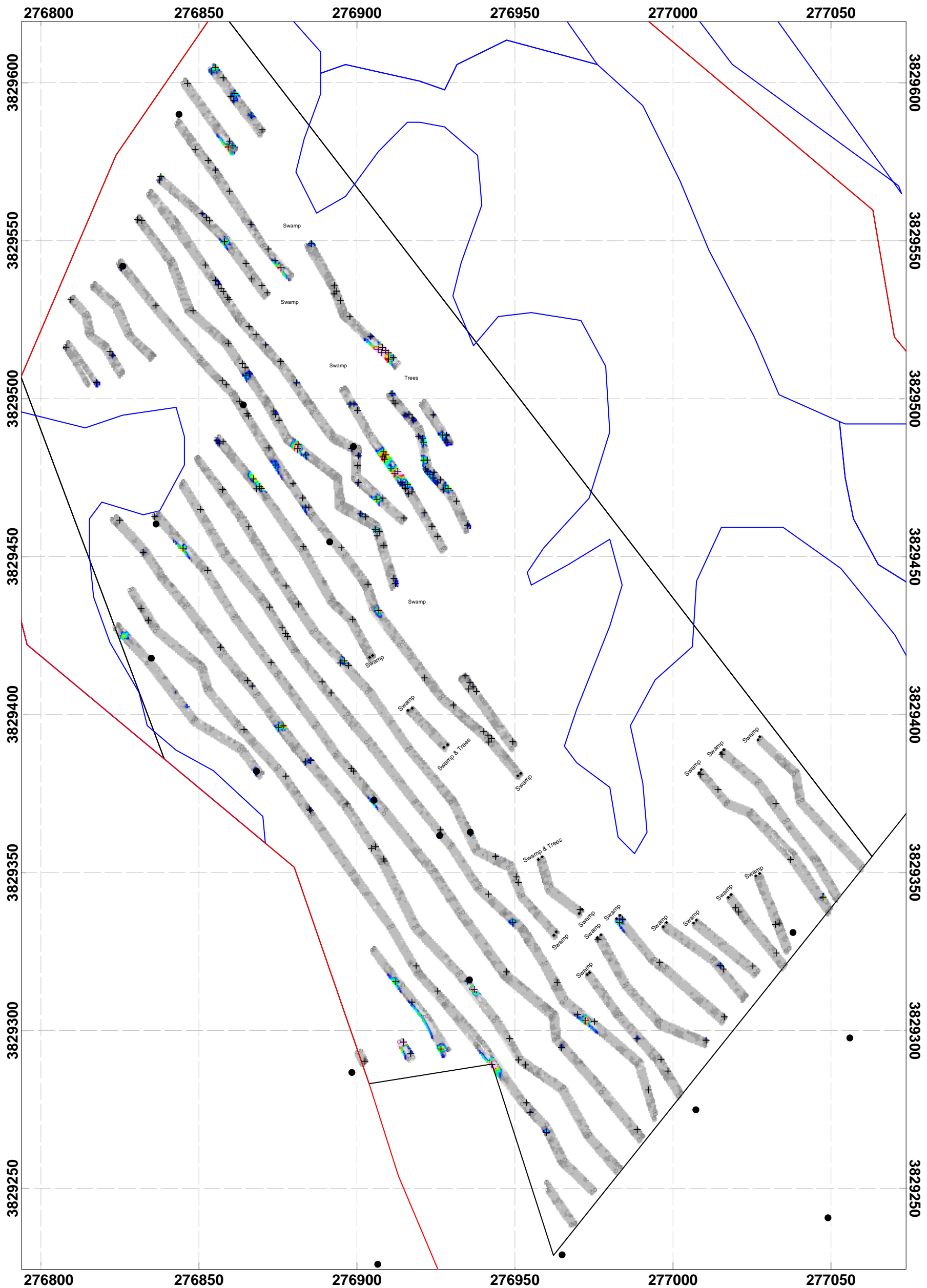
- Culture (if noted) Locations recorded with a 3 to 5 meter accuracy GPS
- ⊕ Proposed MW
- ⊕ Proposed Sample
- ⬜ Potential Area of Interest (AOI)

Plate 3

Client: CH2M HILL

G-858 Magnetometer Vertical Gradient
Site Mosaic
Site 69
Marine Corps Base, Camp Lejeune
Jacksonville, North Carolina

Date of Survey: 02/11/2010 - 02/19/2010
Date of Map Creation: 03/03/2010
Map Approver: J. Gullard



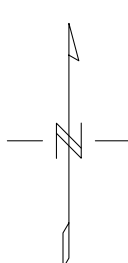
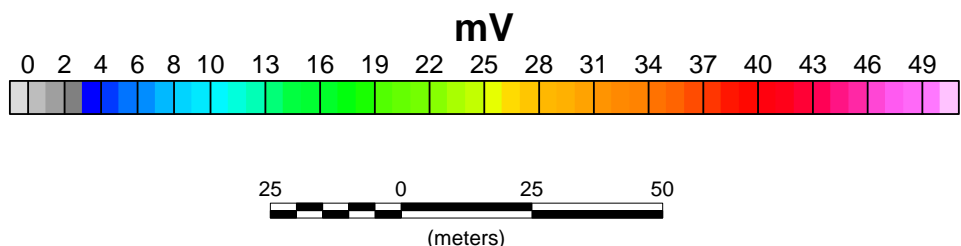
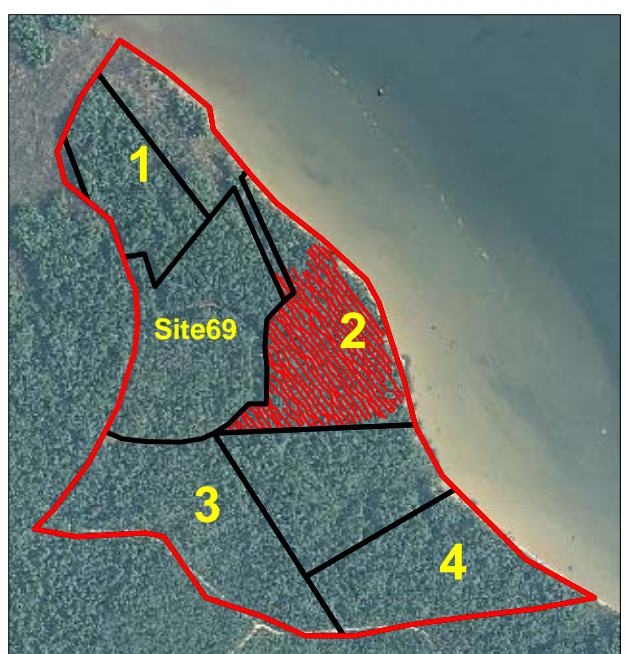
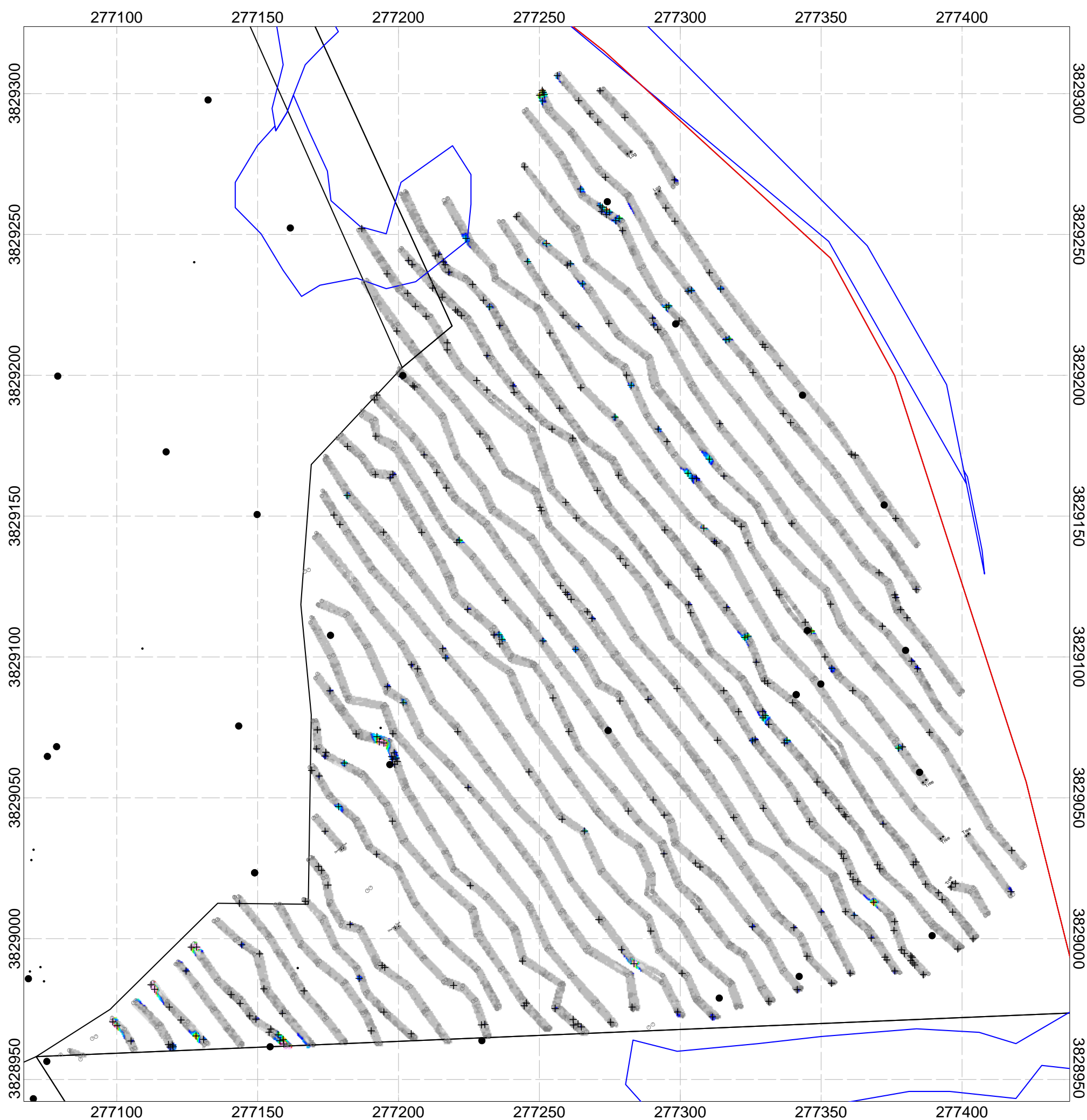
Legend

- Culture (if noted) Locations recorded with a 3 to 5 meter accuracy GPS
- + Targets
- Stake Locations
- Site Boundary
- Wetlands Area



Plate 4

Client: CH2M HILL
EM61 Mk2 Bottom Coil Ch2 Site Mosaic UXO-02 Section 1 Marine Corps Base, Camp Lejeune Jacksonville, North Carolina
Date of Survey: 02/16/2010 - 02/25/2010 Date of Map Creation: 03/03/2010
Map Approver: J. Guillard



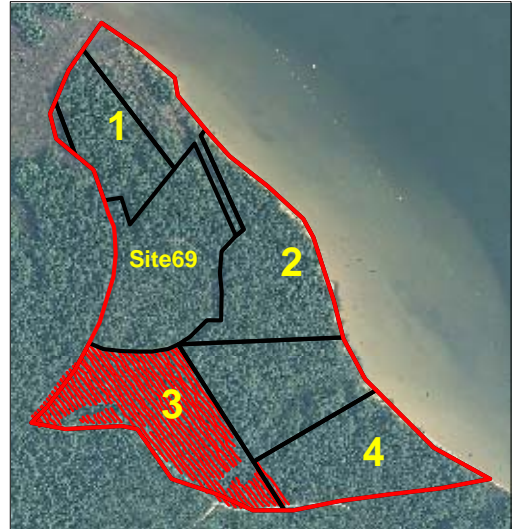
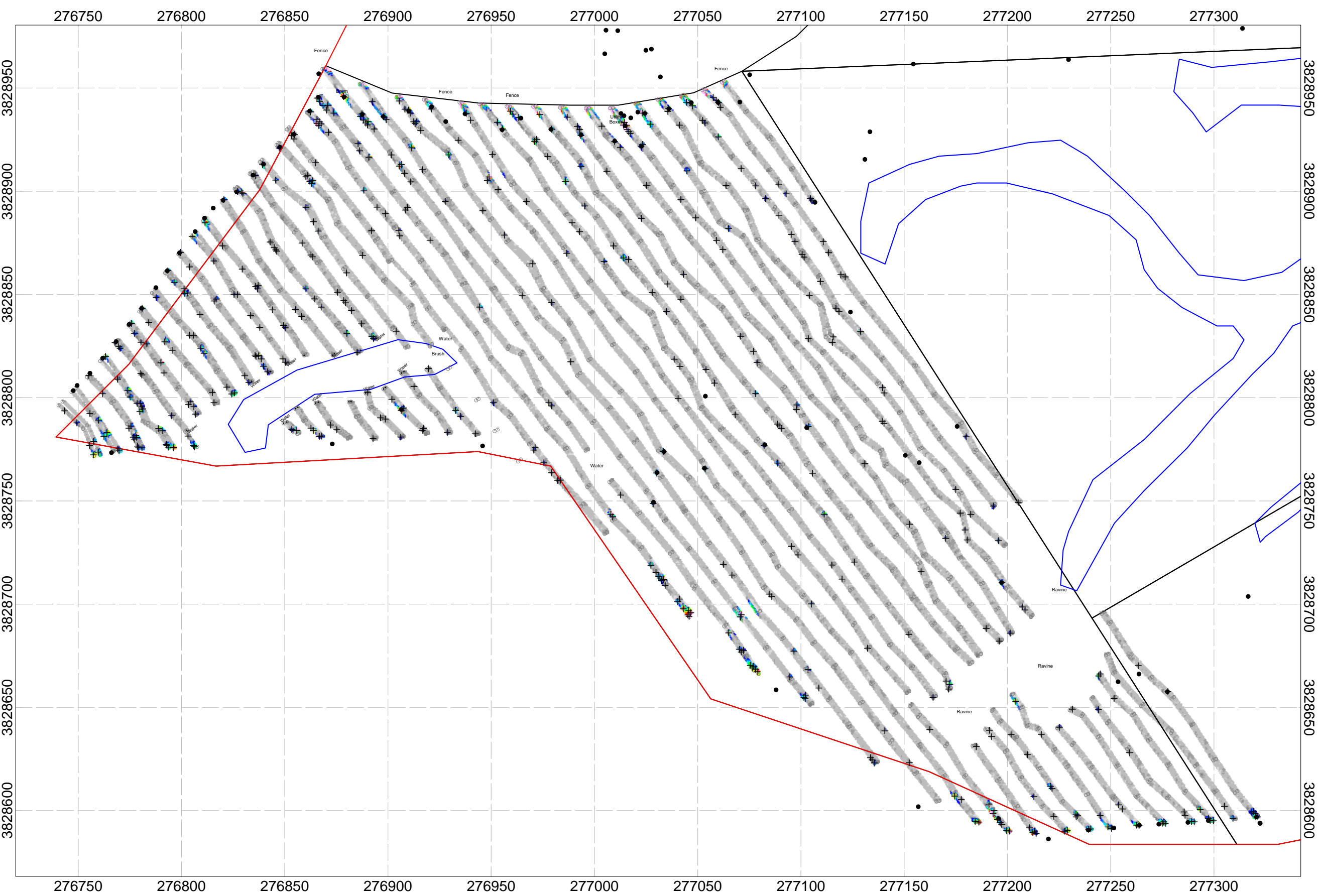
Legend

- Culture (if noted) Locations recorded with a 3 to 5 meter accuracy GPS
- + Targets
- Stake Locations
- Site Boundary
- Wetlands Area



Plate 5

Client: CH2M HILL
EM61 Mk2 Bottom Coil Ch2 Site Mosaic UXO-02 Section 2 Marine Corps Base, Camp Lejeune Jacksonville, North Carolina
Date of Survey: 02/16/2010 - 02/25/2010 Date of Map Creation: 03/03/2010
Map Approver: J. Guillard



- Legend**
- Culture (if noted) Locations recorded with a 3 to 5 meter accuracy GPS
 - + Targets
 - Stake Locations
 - Site Boundary
 - Wetlands Area

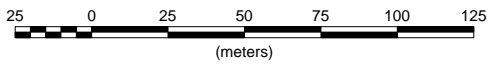
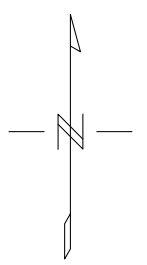
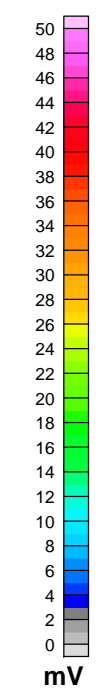


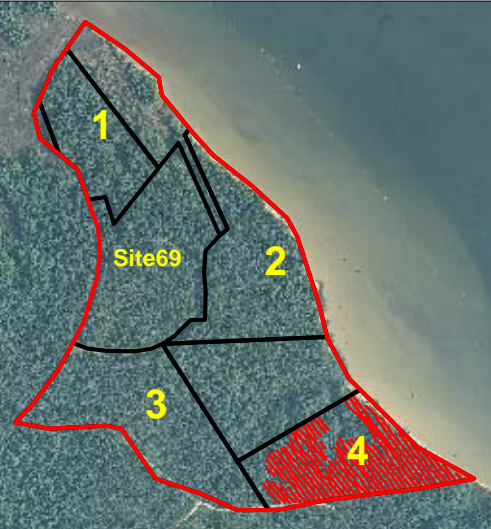
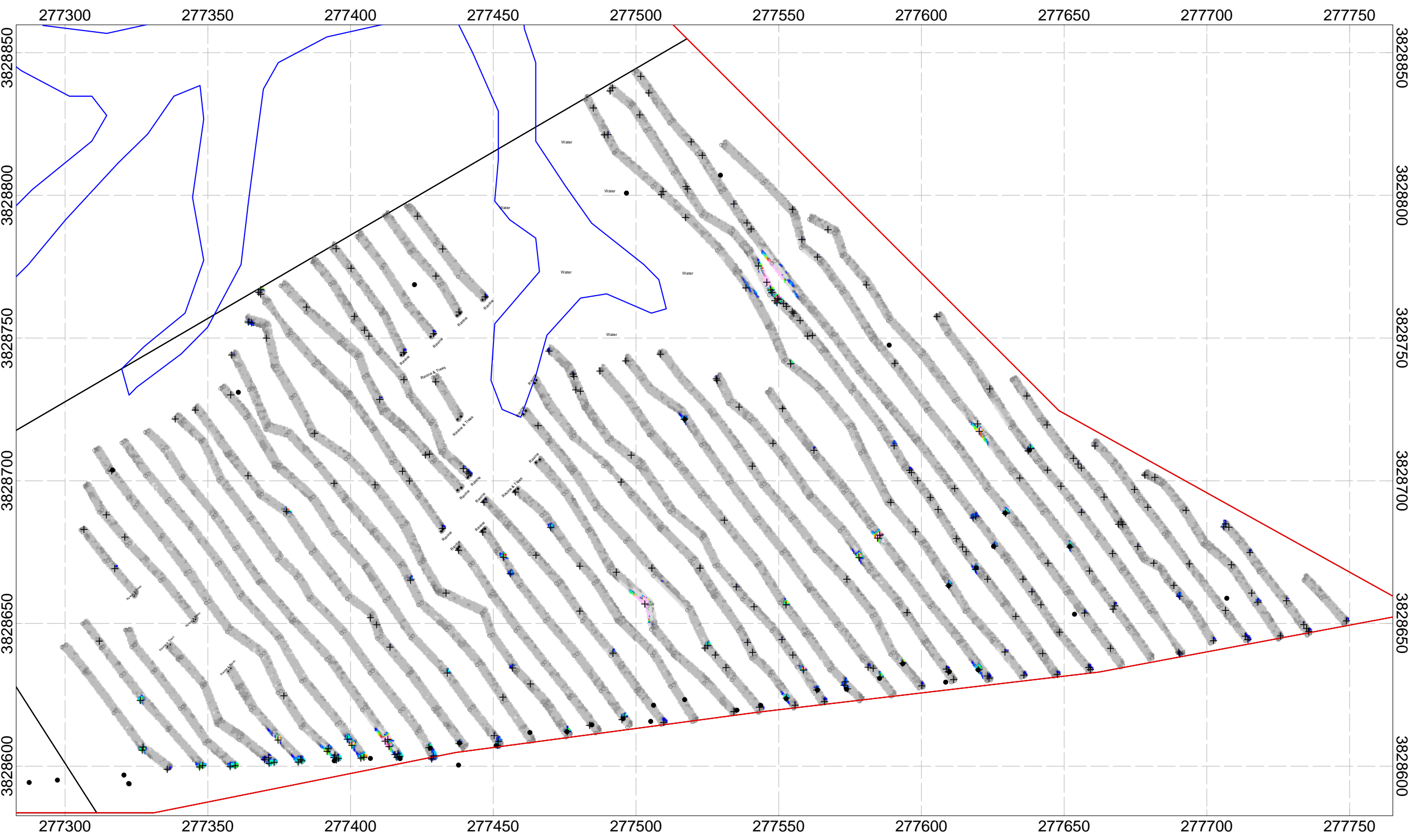
Plate 6

Client: CH2M HILL

EM61 Mk2 Bottom Coil Ch2
Site Mosaic
UXO-02 Section 3
Marine Corps Base, Camp Lejeune
Jacksonville, North Carolina

Date of Survey: 02/16/2010 - 02/25/2010
Date of Map Creation: 03/03/2010

Map Approver: J. Guillard



- Legend**
- Culture (if noted) Locations recorded with a 3 to 5 meter accuracy GPS
 - + Targets
 - Stake Locations
 - Site Boundary
 - Wetlands Area

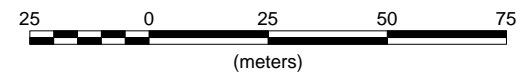
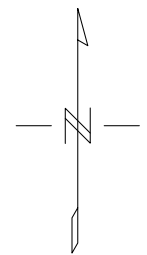
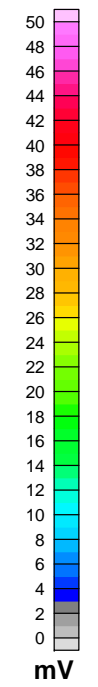
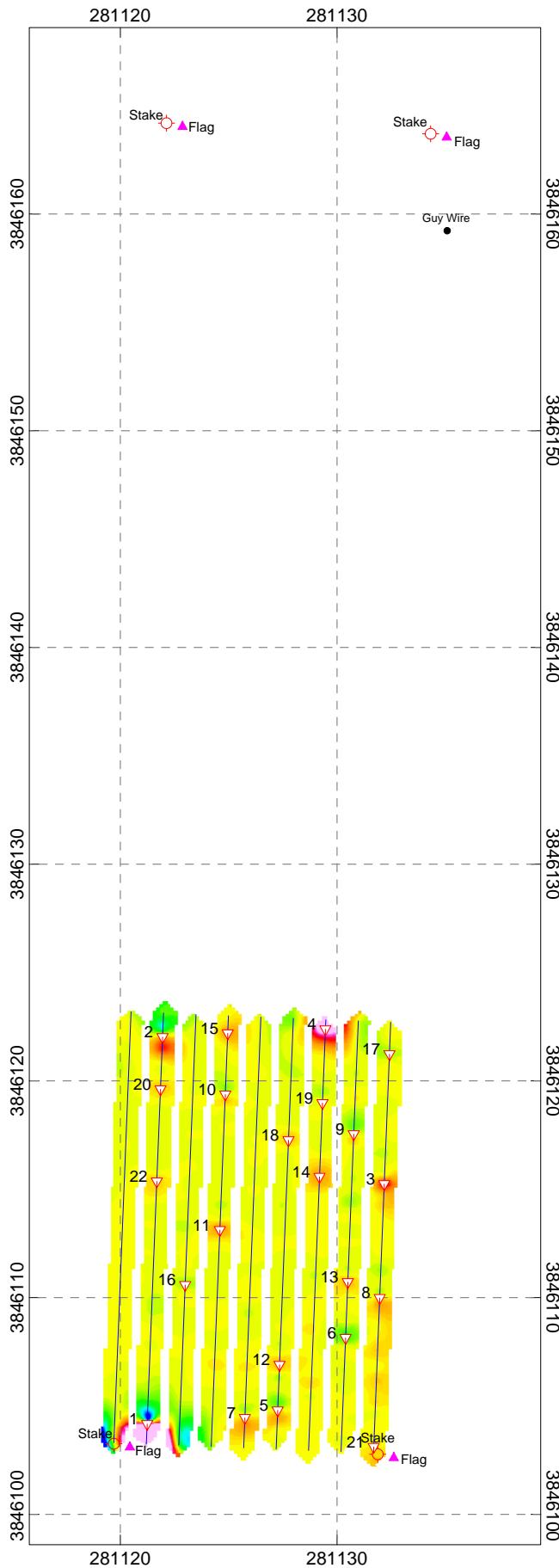


Plate 7

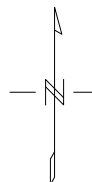
Client: CH2M HILL
EM61 Mk2 Bottom Coil Ch2 Site Mosaic UXO-02 Section 4 Marine Corps Base, Camp Lejeune Jacksonville, North Carolina
Date of Survey: 02/16/2010 - 02/25/2010 Date of Map Creation: 03/03/2010
Map Approver: J. Guillard

APPENDIX A

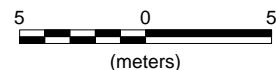


Legend

- 2 Selected Target
(See Target Pick List For Response and Location)
(Unique Target ID is XXX, eg. 002)
- brush ● Culture (if noted)
- Grid Corner (Idealized)
- ▲ Flag Location



Scale 1:300



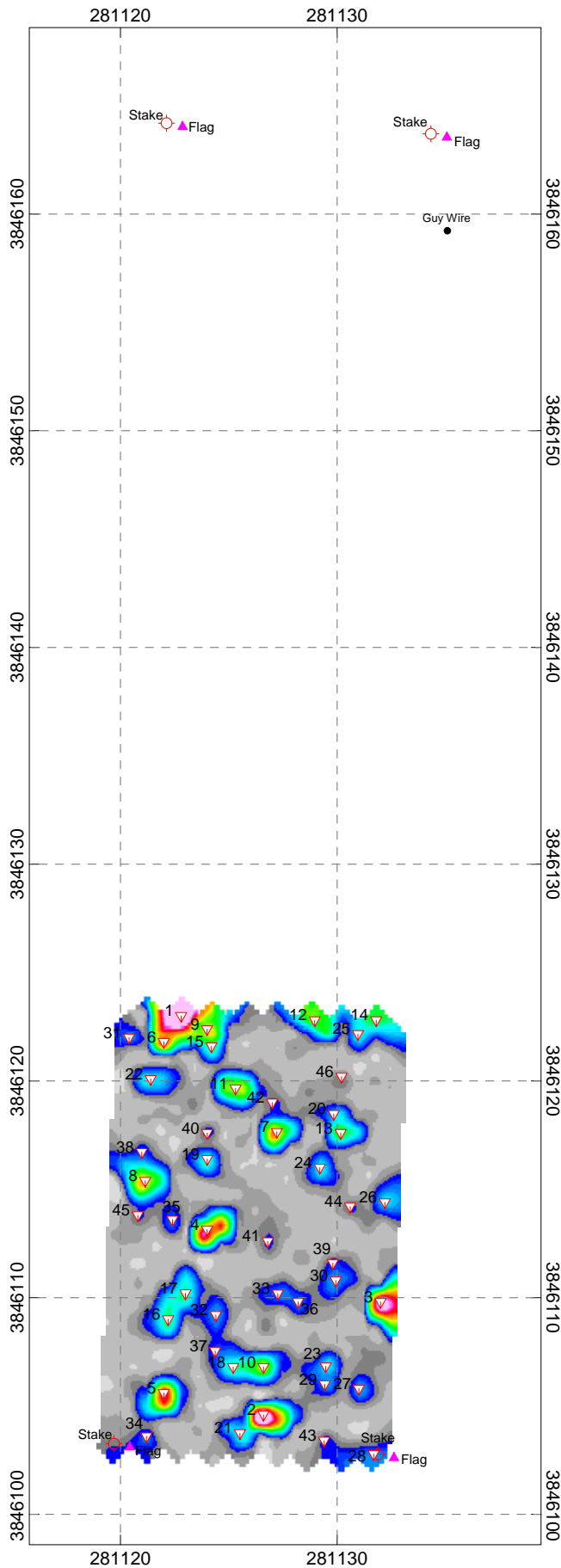
NAD83(NSRS2007) / UTM zone 18N

Client: CH2M HILL

Vertical Gradient from Total Field Magnetics (G-858)
 Geophysical Prove Out (GPO - Warped Fiducials)
 Site 69 and UXO-02
 Marine Corps Base, Camp Lejeune, North Carolina





Date of Survey: 02/09/2010
 Date of Map Creation: 02/12/2010

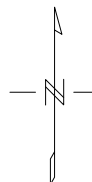
Map Approver: J. Guillard



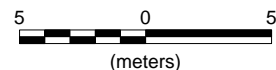
mV
Channel 2

Legend

-  **Selected Target**
(See Target Pick List For Response and Location)
(Unique Target ID is XXX, eg. 002)
-  **Culture (if noted)**
-  **Grid Corner (Idealized)**
-  **Flag Location**



Scale 1:300



NAD83(NSRS2007) / UTM zone 18N

Client: CH2M HILL

EM61 MK2 Bottom Coil
 Geophysical Prove Out (GPO - Warp Fiducials)
 Site 69 and UXO-02
 Marine Corps Base, Camp Lejeune, North Carolina

Date of Survey: 02/09/2010
 Date of Map Creation: 02/10/2010

Map Approver: J. Guillard

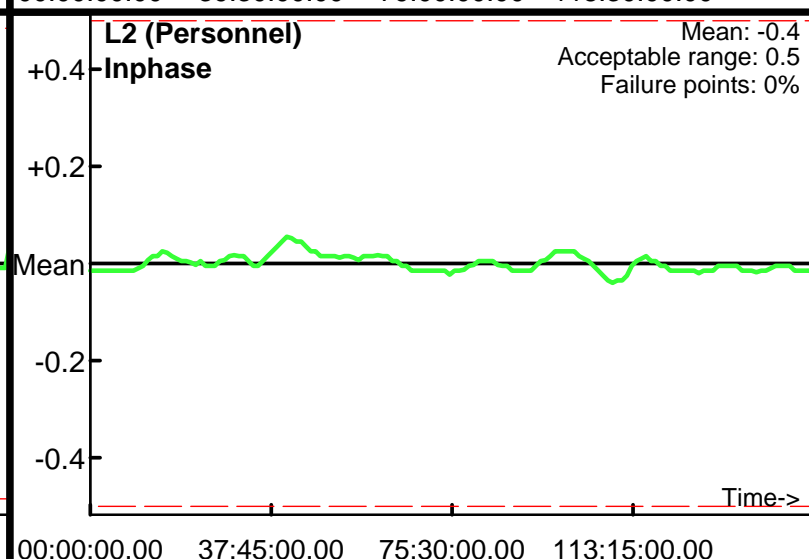
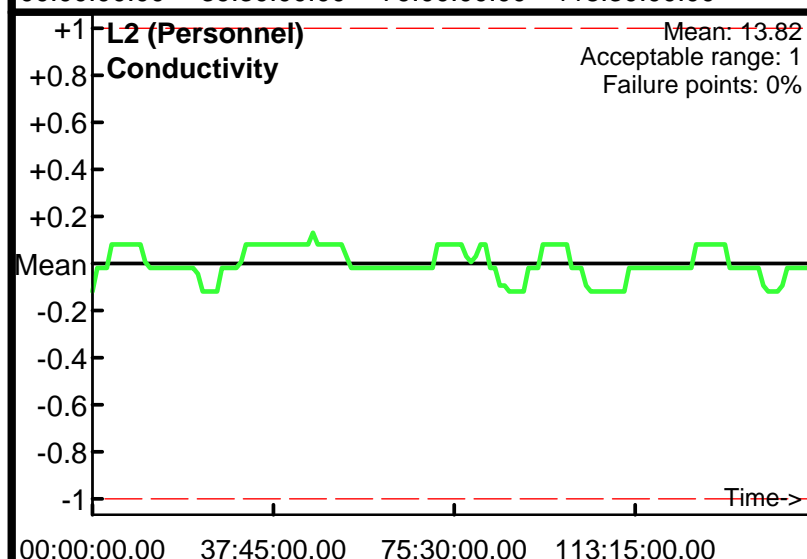
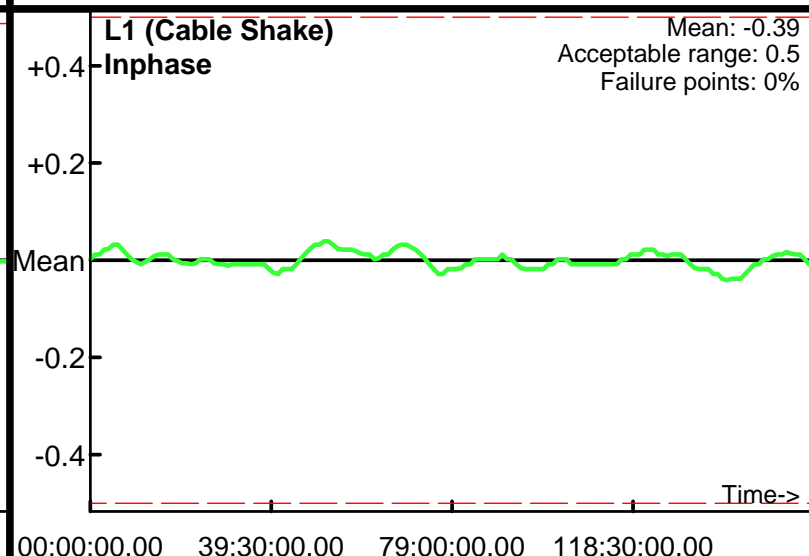
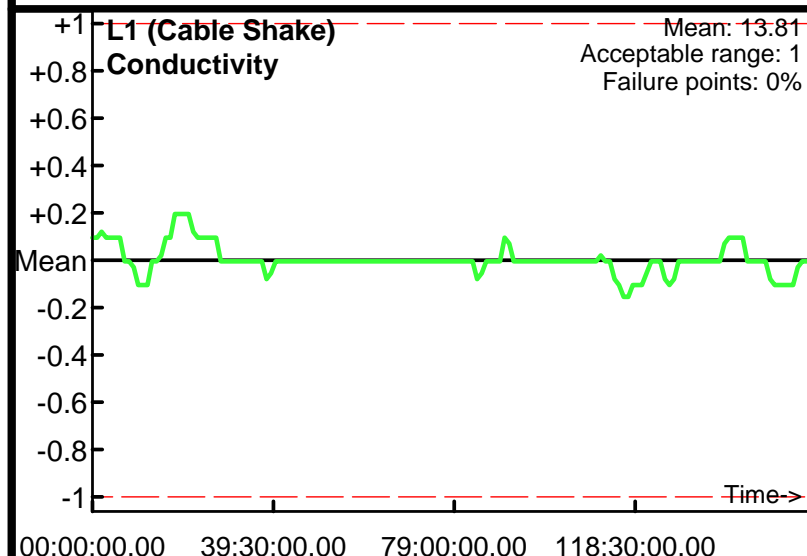
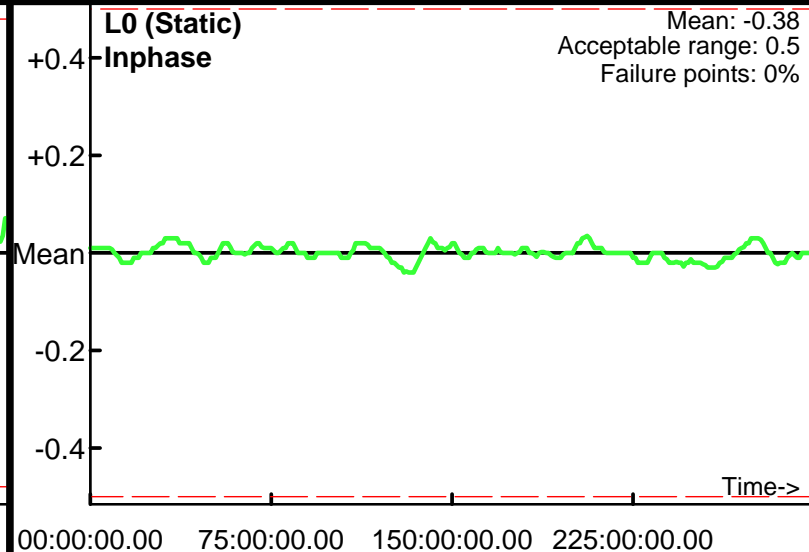
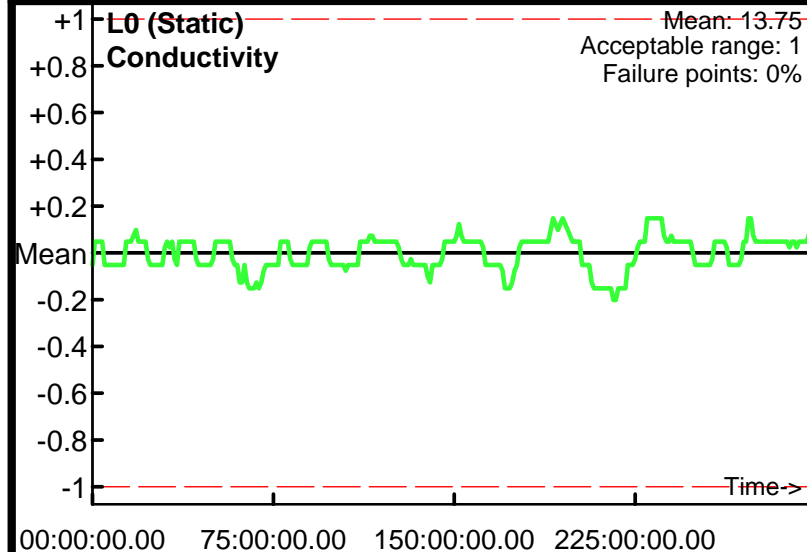
APPENDIX B

Static, Cable Shake and Personnel Test

Project: Site 69 and UXO-02
Equipment: EM31
Grid/Location: Localized QC Area


QC1 test
Operator: GeoA
Date: 2/12/2010

● Outside range
--- Acceptable limits

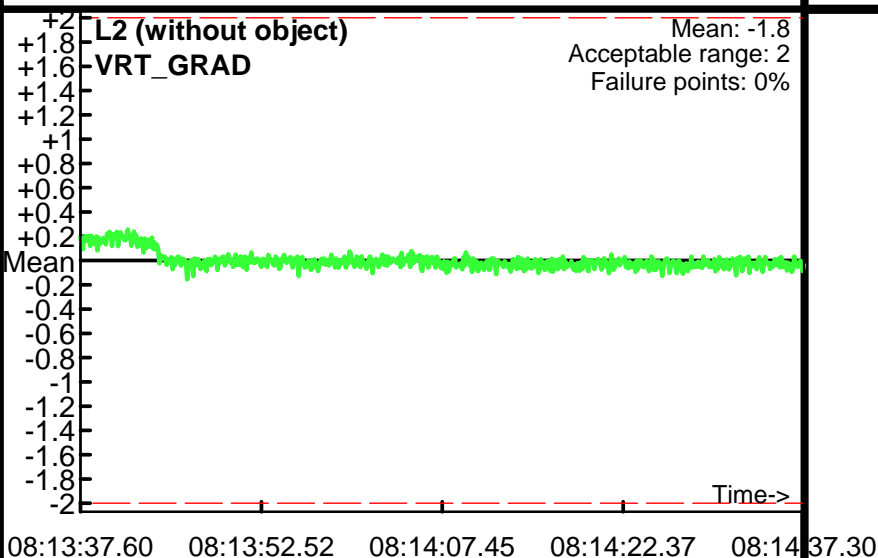
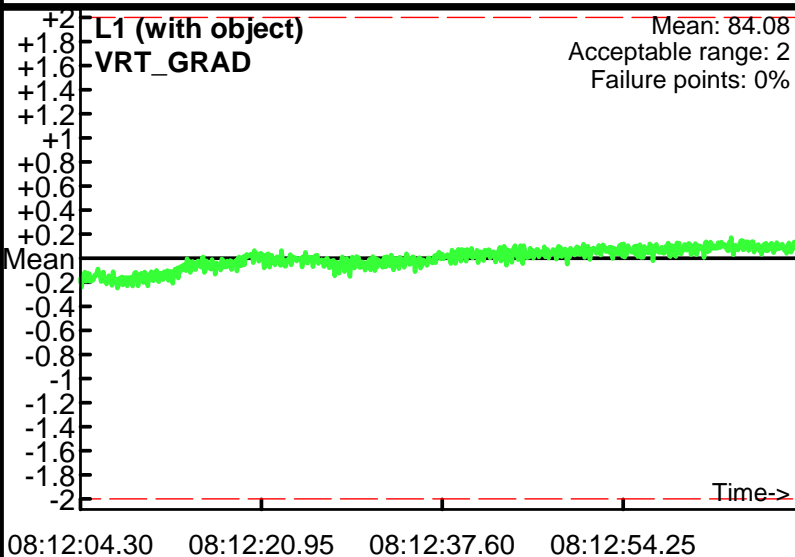
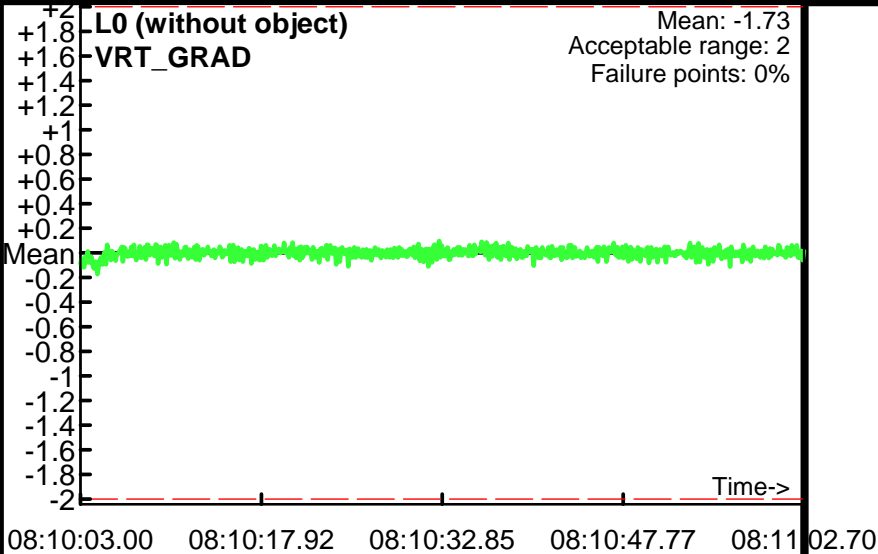


Static Calibration Test

Project: Site 69 and UXO-02
Equipment: Magnetometers
Grid/Location: Localized QC Area

 Outside range
Acceptable limits

QC1 test
Operator: GeoB
Date: 2/12/2010

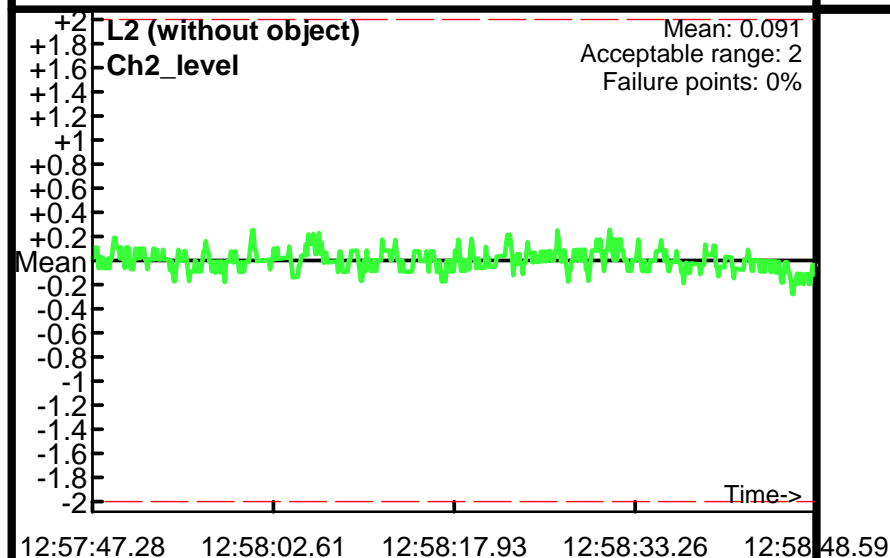
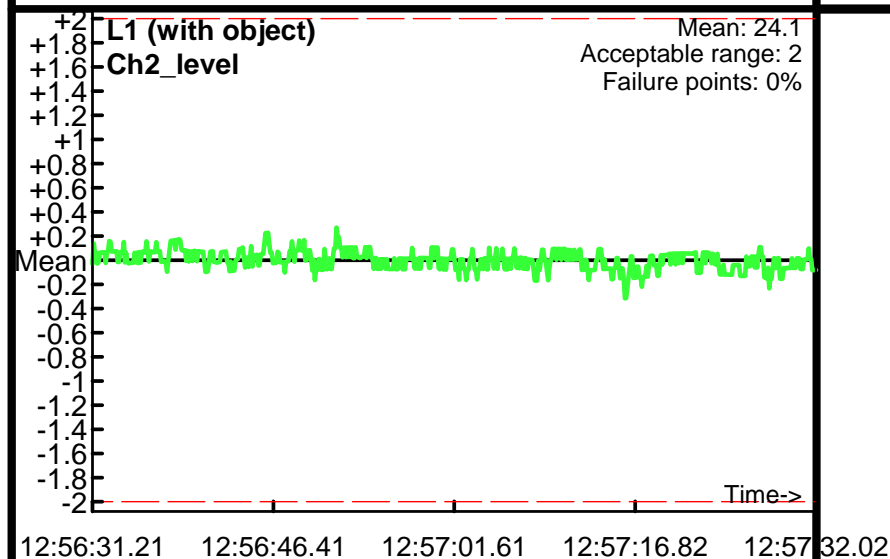
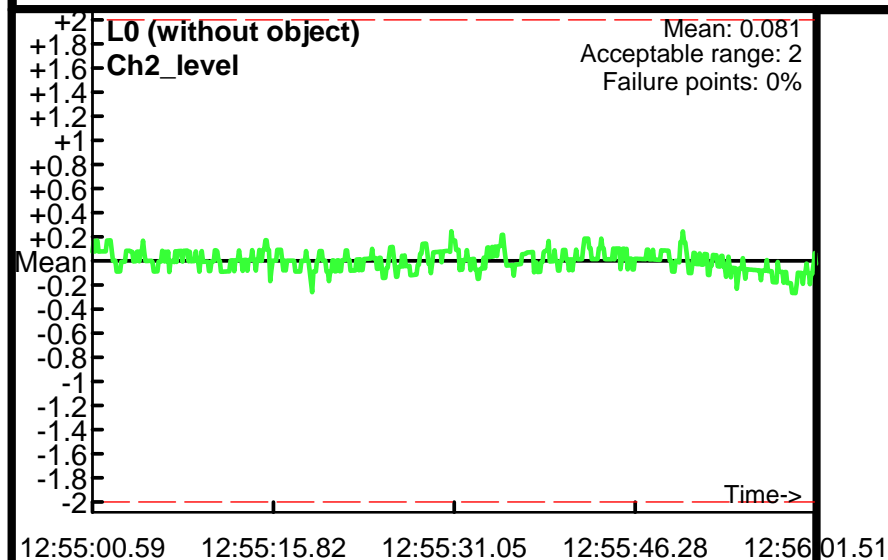


Static Calibration Test

Project: Site 69 and UXO-02
Equipment: EM-61 Mark II
Grid/Location: Localized QC Area


QC1 test
Operator: GeoC
Date: 2/16/2010

● Outside range
--- Acceptable limits

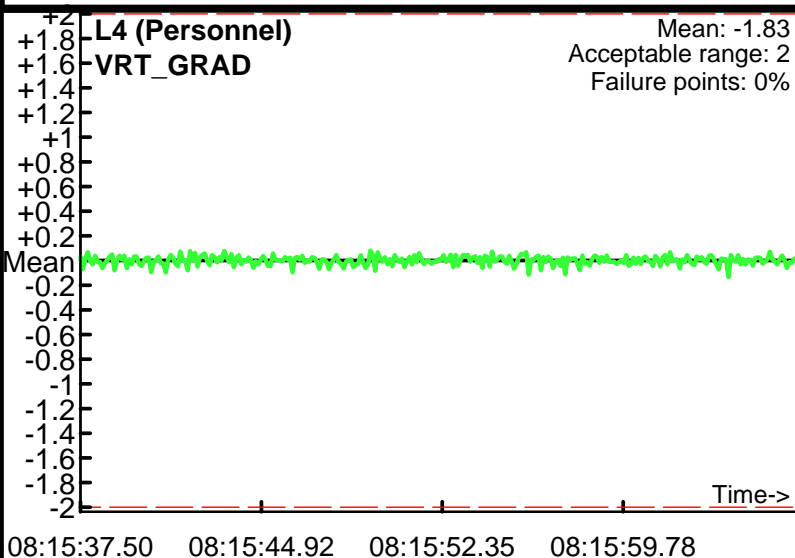
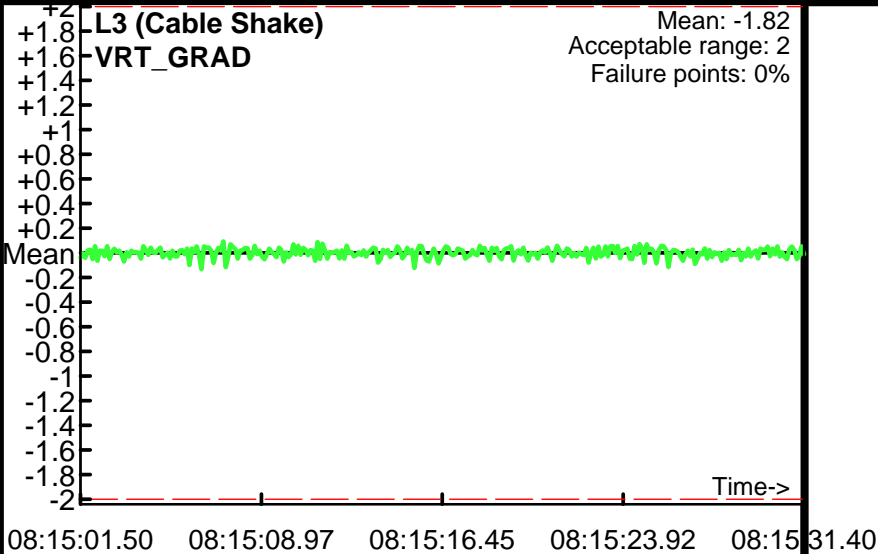


Cable Shake and Personnel Test

Project: Site 69 and UXO-02
Equipment: Magnetometers
Grid/Location: Localized QC Area

 Outside range
— — — Acceptable limits

QC1 test
Operator: GeoB
Date: 2/12/2010

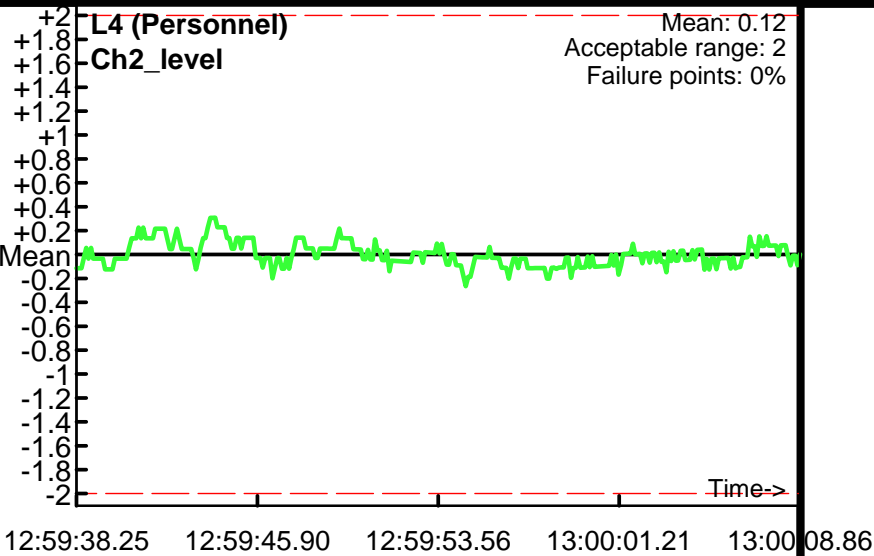
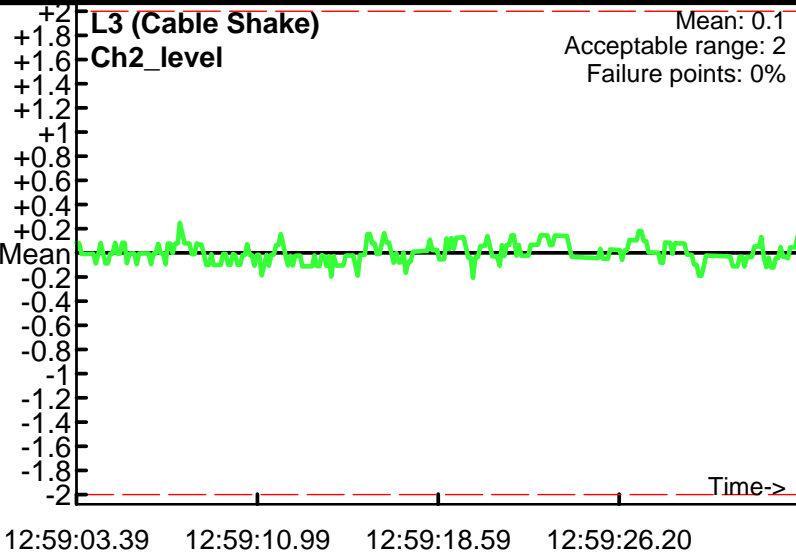


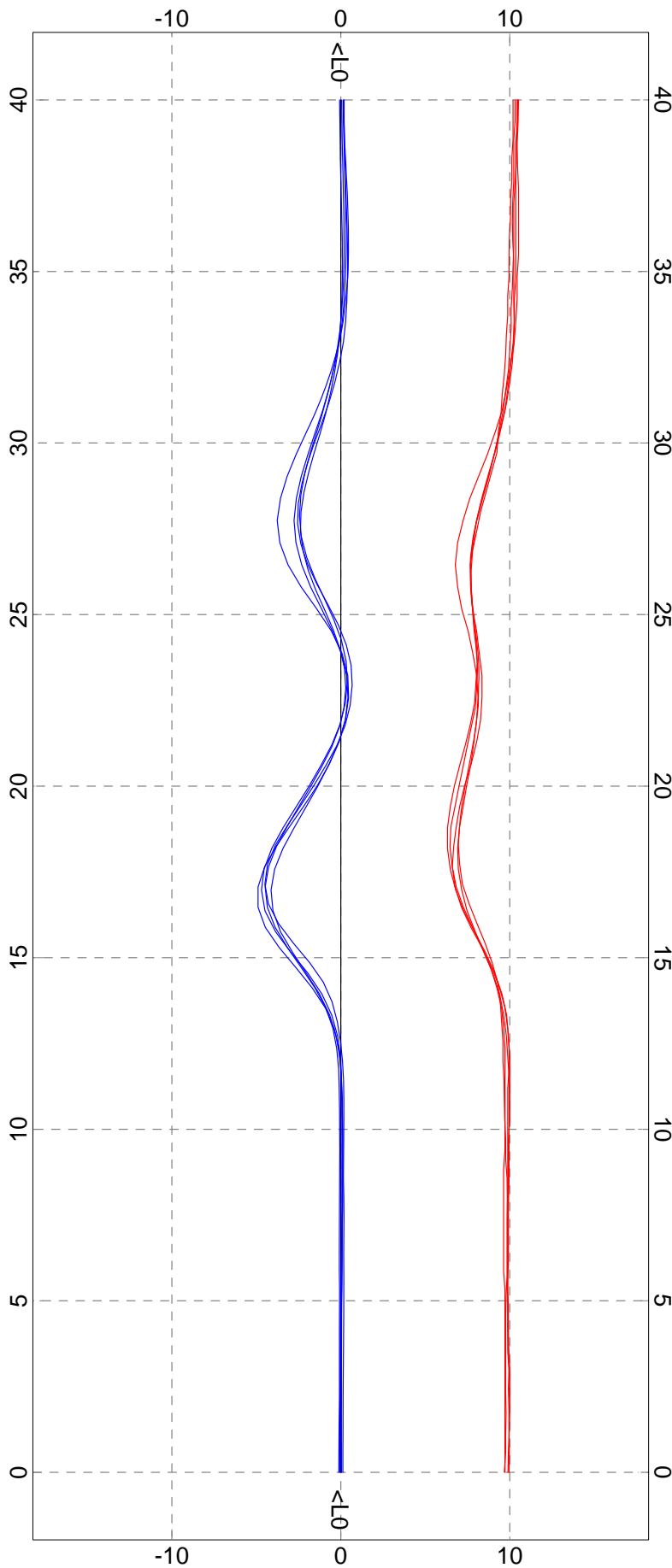
Cable Shake and Personnel Test

Project: Site 69 and UXO-02
Equipment: EM-61 Mark II
Grid/Location: Localized QC Area

● Outside range
— Acceptable limits

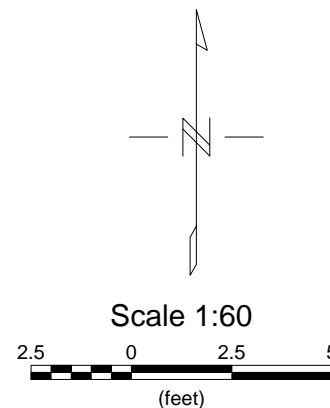
QC1 test
Operator: GeoC
Date: 2/16/2010





Legend

- Line Path
 - Conductivity (mS/m)
 - Inphase (ppt)
- Profile scale is 0.5 units/mm



Client: CH2M HILL

EM31 Dynamic Resposne Test
 Site 69 and UXO-02
 Marine Corps Base, Camp Lejeune, North Carolina

Dates of Survey: 02/10/2010 - 02/12/2010
 Date of Map Creation: 02/16/2010

Map Approver: J. Guillard

Appendix D
Soil Boring Logs and Well Completion
Diagrams



PROJECT NUMBER:
378849.SI.FK

BORING NUMBER:
MR02-TW01

SHEET 1 OF 1

Soil Boring Log

CLIENT : NAVFAC

PROJECT : CTO-14

LOCATION : UXO-02, Camp Lejeune, NC

ELEVATION : 5.44 ft msl

DRILLING CONTRACTOR : Probe Technologies

COORDINATES : 3829548.8 N 276884.6 E

DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers

WATER LEVEL: 3.53 ft btoc

START : 3/22/10 10:49

END : 3/22/10 10:49

LOGGER : J Albano

WATER LEVEL: 3.66 ft bgs		START: 3/22/16 16:43		END: 3/22/16 16:43		LOGGERS: J. Adams	
DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR , MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
5	0.0	4.0	HA-1	0 ppm		CLAYEY SAND (SC) tan, moist, loose.	0ft: Bentonite granules
	0 ppm			SILTY SAND (SM) light brownish gray, moist, very loose to loose.		1ft: 20/30 Silica sand pack	
	0 ppm			SANDY LEAN CLAY (CL) tan and orange, moist, soft, mottled.		2ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack	
	0 ppm						
	4.0	6.0	DP-1	0 ppm			
	0 ppm						
	0 ppm						
	0 ppm						
	0 ppm						
	0 ppm						
10	10.0	2.0	DP-2	0 ppm		CLAYEY SAND (SC) red, wet, medium dense.	12ft: Bottom of well
12.0	0 ppm						
	0 ppm						
15							
20							
25							

FID: Flame ionization detector



Prepared By: Susan Forker
Checked By: Simon Kline

PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW02
SHEET 1 OF 1	
<h2 style="margin: 0;">Soil Boring Log</h2>	

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 11.96 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3829452.6 N 276845.1 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 9.87 ft btoc	START : 3/23/2009	END : 3/23/2009
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS	
						SOIL NAME, USCS GROUP SYMBOL, COLOR , MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		
5	0.0	5.0	HA-1	0 ppm		SILTY SAND (SM) tan, moist, loose.		0ft: Bentonite granules
				0 ppm				
				0 ppm		CLAYEY SAND (SC) tan and orange, moist, loose, mottled.		
				0 ppm				
				0 ppm				
				0 ppm				
	5.0	5.0	DP-1	0 ppm		SANDY LEAN CLAY (CL) tan and orange, moist, medium stiff.	5ft: 20/30 silica sand pack	
				0 ppm				
				0 ppm				
				0 ppm				
				0 ppm				
	0 ppm							
10	10.0	4.0	DP-2	0 ppm	SANDY LEAN CLAY (CL) tan and orange, moist, soft.		7ft: 1 in. diameter 0.010in machine slotted screen with attached 20/30 Silica sand pack	
				0 ppm				
				0 ppm				
				0 ppm				
				0 ppm				
				0 ppm				
	15	15.0	5.0	DP-3	0 ppm	SANDY LEAN CLAY (CL) tan and orange, moist, soft.		17ft: Bottom of well
		0 ppm						
		0 ppm						
		0 ppm						
		0 ppm						
	0 ppm							
20	20.0				CLAYEY SAND (SC) reddish orange, very moist to wet, medium dense.			

FID: Flame ionization detector



PROJECT NUMBER:
378849.SI.FK

BORING NUMBER:
MR02-TW03

SHEET 1 OF 1

Soil Boring Log

CLIENT : NAVFAC

PROJECT : CTO-14

LOCATION : UXO-02, Camp Lejeune, NC

ELEVATION : 7.54 ft msl

DRILLING CONTRACTOR : Probe Technologies

COORDINATES : 3829432.5 N 276906.5 E

DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers

WATER LEVEL: 5.22 ft btoc

START : 3/23/2009

END : 3/23/2009

LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
	0.0		HA-1			SILTY SAND (SM) tan, moist, loose.	0ft: Bentonite granules
	5.0	5.0		0 ppm		SANDY LEAN CLAY (CL) tan and orange, moist, soft to medium stiff, mottled.	2ft: 20/30 Silica sand pack
5	5.0		DP-1	0 ppm			3ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
	10.0			0 ppm		SANDY LEAN CLAY (CL) tan and orange, wet, soft to medium stiff, mottled. SANDY LEAN CLAY (CL) tan and orange, wet, very soft, mottled.	
10	10.0		DP-2	0 ppm			
	15.0			0 ppm		SANDY LEAN CLAY (CL) red, wet, very soft, mottled.	13ft: Bottom of well
15	15.0						
20							
25							

FID: Flame ionization detector



PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW04	SHEET 1 OF 1
Soil Boring Log		

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 11.51 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3829312.8 N 276936.3 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 8.11 ft btoc	START : 3/23/2009	END : 3/23/2009
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR , MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
5	0.0		HA-1	0 ppm		CLAYEY SAND (SC) tan, moist, loose.	0ft: Bentonite granules
		5.0					
	5.0		DP-1	0 ppm		SANDY LEAN CLAY (CL) moist, soft, trace fine sand.	5ft: 20/30 Silica sand pack
		5.0					7ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
15	10.0		DP-2	0 ppm			
		5.0					
	15.0		DP-3	0 ppm		SANDY LEAN CLAY (CL) wet, soft, trace fine sand.	
		5.0				CLAYEY SAND (SC) tan, wet, loose.	
20						SANDY LEAN CLAY (CL) gray, wet, soft, with shells.	17ft: Bottom of well
	20.0						
25							

FID: Flame ionization detector



PROJECT NUMBER:
378849.SI.FK

BORING NUMBER:
MR02-TW06

SHEET 1 OF 1

Soil Boring Log

CLIENT: NAVFAC

PROJECT : CTO-14

LOCATION : UXO-02, Camp Lejeune, NC

ELEVATION : 11.36 ft msl

DRILLING CONTRACTOR : Probe Technologies

COORDINATES : 3829234.2 N 277127.3 E

DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers

WATER LEVEL: 6.11 ft btoc

START : 3/23/2009

END : 3/23/2009

LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)		INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
0.0		0.0	5.0	HA-1	0 ppm		SILTY SAND (SM) tan, moist, loose.	0ft: Bentonite granules
5.0		5.0	3.0	DP-1	0 ppm		SANDY LEAN CLAY (CL) tan and orange, moist, medium stiff, mottled. SANDY LEAN CLAY (CL) tan and orange, wet, medium stiff, mottled. No recovery.	2ft: 20/30 Silica sand pack 3ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
10.0		10.0	5.0	DP-2	0 ppm		SANDY LEAN CLAY (CL) tan and orange, wet, medium stiff, mottled.	13ft: Bottom of well
15.0		15.0			0 ppm		SILTY SAND (SM) tan, wet, loose.	
20.0								
25.0								

FID: Flame ionization detector



Prepared By: Susan Forker
Checked By: Simon Kline

PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW08
SHEET 1 OF 1	
<h2 style="margin: 0;">Soil Boring Log</h2>	

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 12.12 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3829342.0 N 277047.2 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 5.38 ft btoc	START : 3/23/2009	END : 3/23/2009
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
	0.0		HA-1	0 ppm		SILTY SAND (SM) tan, moist, loose.	0ft: Bentonite granules
		5.0				CLAYEY SAND (SC) tannish orange, moist, loose.	2ft: 20/30 Silica sand pack
5	5.0		DP-1	0 ppm		SANDY LEAN CLAY (CL) tan and orange, moist, medium stiff, mottled.	3ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
		2.5				SILTY SAND (SM) tan, saturated, loose. No recovery.	
10	10.0		DP-2	0 ppm		SANDY LEAN CLAY (CL) tan and orange, moist, medium stiff, mottled.	
		5.0					13ft: Bottom of well
15	15.0			0 ppm			
20							
25							

FID: Flame ionization detector



Prepared By: Susan Forker
Checked By: Simon Kline

PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW09
SHEET 1 OF 1	
<h2 style="margin: 0;">Soil Boring Log</h2>	

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 13.62 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3829295.0 N 277247.1 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 12.51 ft btoc	START : 3/23/2009	END : 3/23/2009
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
	0.0					SILTY SAND (SM) tan, moist, loose.	0ft: Bentonite granules
		5.0	HA-1	0 ppm		SANDY LEAN CLAY (CL) tan and orange, moist, soft, mottled.	
5	5.0			0 ppm			
		5.0	DP-1	0 ppm			7ft: 20/30 Silica sand pack
10	10.0			0 ppm		SANDY LEAN CLAY (CL) tan and orange, wet, soft, mottled.	9ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
		5.0	DP-2	0 ppm			
15	15.0			0 ppm			
		5.0	DP-3	0 ppm		CLAYEY SAND (SC) orange, wet, loose.	
20	20.0					SILTY SAND (SM) red and orange, wet, medium dense, laminated.	19ft: Bottom of well
25							

FID: Flame ionization detector



PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW10	SHEET 1 OF 1
<h2>Soil Boring Log</h2>		

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 31.70 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3829122.8 N 277197.7 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 8.28 ft btoc	START : 3/24/2010	END : 3/24/2010
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
5	0.0	5.0	HA-1	0 ppm		<u>SANDY SILT (ML)</u> black, moist, soft, with organics.	
						<u>SANDY SILT (ML)</u> brown, moist, soft.	
	5.0			0 ppm		<u>SILTY SAND (SM)</u> grayish brown, wet, loose.	
10		2.5	DP-1			No recovery.	
	10.0			0 ppm		<u>SILTY SAND (SM)</u> grayish brown, wet, loose.	
15		4.0	DP-2			<u>SANDY LEAN CLAY (CL)</u> gray, wet, very soft.	
						No recovery.	
	15.0						
20							
25							

FID: Flame ionization detector



PROJECT NUMBER:
378849.SI.FK

BORING NUMBER:
MR02-TW11

SHEET 1 OF 1

Soil Boring Log

CLIENT: NAVFAC PROJECT: CTO-14 LOCATION: UXO-02, Camp Lejeune, NC
ELEVATION: 30.49 ft msl DRILLING CONTRACTOR: Probe Technologies
COORDINATES: 3829160.1 N 277281.8 E DRILLING METHOD AND EQUIPMENT: DPT with Geoprobe 7720DT, Macro-core samplers
WATER LEVEL: 8.12 ft btoc START: 3/24/2010 END: 3/24/2010 LOGGER: J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
0	0.0			0 ppm		POORLY GRADED SAND (SP) whiteish tan, moist, loose.	0ft: Bentonite granules
5	5.0	5.0	HA-1	0 ppm			4ft: 20/30 Silica sand pack
10	10.0	2.5	DP-1	0 ppm		POORLY GRADED SAND (SP) light orange, wet, loose. No recovery.	5ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
15	15.0	5.0	DP-2	0 ppm		POORLY GRADED SAND (SP) light orange, wet, loose. CLAYEY SAND (SC) tannish orange, wet, loose.	
20							15ft: Bottom of well
25							

FID: Flame ionization detector



PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW12	SHEET 1 OF 1
<h2>Soil Boring Log</h2>		

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 31.08 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3829198.6 N 277339.8 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 11.71 ft btoc	START : 3/24/2010	END : 3/24/2010
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
	0.0			0 ppm		SANDY SILT (ML) black, very moist, soft, with organics.	0ft: Bentonite granules
		5.0	HA-1				
5	5.0			0 ppm		SILTY SAND (SM) gray, saturated, loose, trace organics.	4ft: 20/30 Silica sand pack
		2.0	DP-1			No recovery.	5ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
10	10.0			0 ppm		SILTY SAND (SM) gray, saturated, loose, trace organics.	
		5.0	DP-2			SANDY LEAN CLAY (CL) gray, wet, soft.	
15	15.0						15ft: Bottom of well
20							
25							

FID: Flame ionization detector



PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW13	SHEET 1 OF 1
<div>Soil Boring Log</div>		

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 33.56 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3829024.8 N 277172.1 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 5.42 ft btoc	START : 3/24/2010	END : 3/24/2010 LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
5	0.0	5.0	HA-1	0 ppm		SILTY SAND (SM) black, moist, soft, some organics.	0ft: Bentonite granules
	5.0			0 ppm		SILTY SAND (SM) brown, wet, loose.	1ft: 20/30 Silica sand pack
		2.0	DP-1			No recovery.	2ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
10	10.0	5.0	DP-2	0 ppm		SILTY SAND (SM) brown, wet, loose.	12ft: Bottom of well
						SANDY LEAN CLAY (CL) gray, wet, soft.	
15	15.0						
20							
25							

FID: Flame ionization detector



Prepared By: Susan Forker
Checked By: Simon Kline

PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW14
SHEET 1 OF 1	
<h2 style="margin: 0;">Soil Boring Log</h2>	

CLIENT: NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 34.10 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3829023.4 N 277210.4 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 4.9 ft btoc	START : 3/25/2010	END : 3/25/2010
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
5	0.0		HA-1	0 ppm		SILTY SAND (SM) tan, very moist, loose.	0ft: Bentonite granules
	5.0	5.0					2ft: 20/30 Silica sand pack
			DP-1	0 ppm		POORLY GRADED SAND (SP) tan, wet, loose.	3ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
		2.0				No recovery.	
10	10.0		DP-2	0 ppm		POORLY GRADED SAND (SP) tan, wet, loose.	
		5.0				SANDY LEAN CLAY (CL) gray, wet, very soft.	13ft: Bottom of well
15	15.0					SILTY SAND (SM) brown, wet, loose.	
20							
25							

FID: Flame ionization detector



PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW15	SHEET 1 OF 1
Soil Boring Log		

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 35.25 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3829089.5 N 277268.0 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 7.12 ft btoc	START : 3/25/2010	END : 3/25/2010
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
5	0.0		HA-1	0 ppm		SILTY SAND (SM) gray, moist, loose.	0ft: Bentonite granules
		5.0				POORLY GRADED SAND (SP) gray, moist, loose.	2ft: 20/30 Silica sand pack
	5.0		DP-1	0 ppm		POORLY GRADED SAND (SP) gray, moist, loose.	3ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
		3.0				No recovery.	
10	10.0		DP-2	0 ppm		POORLY GRADED SAND (SP) gray, moist, loose.	
		5.0				SANDY LEAN CLAY (CL) gray, wet, very soft.	13ft: Bottom of well
	15.0					SILTY SAND (SM) brown, very moist, loose.	
20							
25							

FID: Flame ionization detector



PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW16	SHEET 1 OF 1
<h2>Soil Boring Log</h2>		

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 12.17 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3829063.1 N 277395.4 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 9.69 ft btoc	START : 3/24/2010	END : 3/24/2010
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
	0.0			0 ppm		POORLY GRADED SAND (SP) white, moist, loose.	0ft: Bentonite granules
		5.0	HA-1				
5	5.0			0 ppm		SILTY SAND (SM) tan, very moist, medium dense.	4ft: 20/30 Silica sand pack
		4.0	DP-1			POORLY GRADED SAND (SP) tan, wet, loose. No recovery.	5ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
10	10.0					POORLY GRADED SAND (SP) tan, wet, loose.	
		4.0	DP-2			SANDY LEAN CLAY (CL) tannish orange, moist, very soft. No recovery.	
15	15.0						15ft: Bottom of well
20							
25							

FID: Flame ionization detector



Prepared By: Susan Forker
Checked By: Simon Kline

PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW17
SHEET 1 OF 1	
<h2 style="margin: 0;">Soil Boring Log</h2>	

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 23.67 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3828854.5 N 276836.4 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 8.07 ft btoc	START : 3/22/2010	END : 3/22/2010
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS	
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		
5	0.0					POORLY GRADED SAND (SP) gray, moist, loose.		0.5ft: Bentonite granules
		5.0	HA-1	0 ppm				
	5.0			0 ppm		SANDY LEAN CLAY (CL) tannish gray, moist, very soft, mottled.		3ft: 20/30 Silica sand pack
		5.0	DP-1	0 ppm				4ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
10	10.0			0 ppm				
		4.0	DP-2	0 ppm		SANDY LEAN CLAY (CL) gray, moist, very soft. No recovery.		14ft: Bottom of well
15	15.0							
20								
25								

FID: Flame ionization detector



Prepared By: Susan Forker
Checked By: Simon Kline

PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW18
SHEET 1 OF 1	
<h2 style="margin: 0;">Soil Boring Log</h2>	

CLIENT: NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 26.86 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3828900.2 N 276952.6 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 3.86 ft btoc	START : 3/22/2009	END : 3/22/2009
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
	0.0					SILTY SAND (SM) tan, very moist, loose.	0ft: Bentonite granules
		5.0	HA-1	0 ppm		CLAYEY SAND (SC) tan, very moist, soft.	3ft: 20/30 Silica sand pack
5	5.0			0 ppm		CLAYEY SAND (SC) tan, saturated, soft.	5ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
	7.5	2.5	DP-1			No recovery.	
15							15ft: Bottom of well
20							
25							

FID: Flame ionization detector



Prepared By: Susan Forker
Checked By: Simon Kline

PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW19
SHEET 1 OF 1	
<h2 style="margin: 0;">Soil Boring Log</h2>	

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 34.06 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3828926.4 N 277060.4 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 6.4 ft btoc	START : 3/25/2010	END : 3/25/2010
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
	0.0			0 ppm		POORLY GRADED SAND (SP) tan, moist, loose.	0ft: Bentonite granules
		5.0	HA-1			CLAYEY SAND (SC) tan and orange, moist, loose.	2ft: 20/30 Silica sand pack
5	5.0			0 ppm		POORLY GRADED SAND (SP) tan, wet, loose.	3ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
		4.0	DP-1			CLAYEY SAND (SC) gray, wet, loose. No recovery.	
10	10.0			0 ppm		CLAYEY SAND (SC) gray, wet, loose.	
		4.0	DP-2			SANDY LEAN CLAY (CL) gray, wet, soft.	
15	15.0					No recovery.	13ft: Bottom of well
20							
25							

FID: Flame ionization detector



PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW20
SHEET 1 OF 1	
<h2 style="margin: 0;">Soil Boring Log</h2>	

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 29.11 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3828781.5 N 277017.6 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 3.32 ft btoc	START : 3/22/2009	END : 3/22/2009
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
	0.0		HA-1	0 ppm		POORLY GRADED SAND (SP) gray, very moist, loose, trace.	<div style="background-color: black; width: 100%; height: 10px; margin-bottom: 5px;"></div> 0ft: Bentonite granules 1ft: 20/30 Silica sand pack 2ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
	5.0	5.0				CLAYEY SAND (SC) tan and light orange, very moist, loose, mottled.	
5			DP-1	0 ppm		CLAYEY SAND (SC) tan and orange, saturated, loose, mottled.	
		2.5				SANDY LEAN CLAY (CL) gray, very moist, soft. No recovery.	
10			DP-2	0 ppm		SANDY LEAN CLAY (CL) gray, very moist, soft.	
		4.0					
	14.0			0 ppm			12ft: Bottom of well
15							
20							
25							

FID: Flame ionization detector



Prepared By: Susan Forker
Checked By: Simon Kline

PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW21
SHEET 1 OF 1	
<h2 style="margin: 0;">Soil Boring Log</h2>	

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 30.75 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3828799.8 N 277143.1 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 7.41 ft btoc	START : 3/25/2010	END : 3/25/2010
	LOGGER : J Albano	

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
5	0.0		HA-1	0 ppm		SILTY SAND (SM) tan, moist, loose.	0ft: Bentonite granules
		5.0					
	5.0		DP-1	0 ppm		CLAYEY SAND (SC) tan and orange, very moist, loose, mottled.	3ft: 20/30 Silica sand pack
		4.0				POORLY GRADED SAND (SP) tan, wet, loose. No recovery.	4ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
10	10.0		DP-2	0 ppm		POORLY GRADED SAND (SP) tan, wet, loose.	
		3.0				SILTY SAND (SM) brown, wet, loose. SANDY LEAN CLAY (CL) gray, very moist, soft. No recovery.	14ft: Bottom of well
15	15.0						
20							
25							

FID: Flame ionization detector



PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW22
SHEET 1 OF 1	
<h2 style="margin: 0;">Soil Boring Log</h2>	

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 30.90 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3828686.4 N 277064.6 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 5.51 ft btoc	START : 3/22/2009	END : 3/22/2009
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
	0.0		HA-1	0 ppm		SILTY SAND (SM) blackish gray, very moist, loose.	0ft: Bentonite granules
		5.0		0 ppm		SILTY SAND (SM) blackish gray, saturated, loose.	1ft: 20/30 Silica sand pack
5	5.0		DP-1	0 ppm		SANDY LEAN CLAY (CL) gray, saturated, soft. No recovery.	2ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
		2.5		0 ppm		SILTY SAND (SM) brown, saturated, loose.	
10	10.0		DP-2	0 ppm			
		2.0					
	12.5						12ft: Bottom of well
15							
20							
25							

FID: Flame ionization detector



PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW23	SHEET 1 OF 1
Soil Boring Log		

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 33.03 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3828597.4 N 277245.2 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 3.9 ft btoc	START : 3/26/2010	END : 3/26/2010
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
5	0.0	5.0	HA-1	0 ppm		POORLY GRADED SAND (SP) tan, very moist, loose.	<div>0ft: Bentonite granules</div> <div>1ft: 20/30 Silica sand pack</div> <div>2ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack</div> <div>12ft: Bottom of well</div>
						SILTY SAND (SM) brown, wet, loose.	
	5.0	3.0	DP-1	0 ppm		SILTY SAND (SM) brown, wet, loose.	
						No recovery.	
10	10.0	2.0	DP-2	0 ppm		SILTY SAND (SM) brown, wet, loose.	
						No recovery.	
15	15.0						
20							
25							

FID: Flame ionization detector



Prepared By: Susan Forker
Checked By: Simon Kline

PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW24
SHEET 1 OF 1	
<h2 style="margin: 0;">Soil Boring Log</h2>	

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 31.57 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3828670.8 N 277365.5 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 5.44 ft btoc	START : 3/26/2010	END : 3/26/2010
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
5	0.0		HA-1	0 ppm		SANDY SILT (ML) brown, moist, soft.	0ft: Bentonite granules
		5.0					2ft: 20/30 Silica sand pack
	5.0			0 ppm		POORLY GRADED SAND (SP) tan, wet, loose.	3ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
10			DP-1			No recovery.	
		2.0					
	10.0			0 ppm		POORLY GRADED SAND (SP) tan, wet, loose.	
15			DP-2			SANDY LEAN CLAY (CL) gray, wet, very soft.	13ft: Bottom of well
		3.0				No recovery.	
	15.0						
20							
25							

FID: Flame ionization detector



PROJECT NUMBER:
378849.SI.FK

BORING NUMBER:
MR02-TW25

SHEET 1 OF 1

Soil Boring Log

CLIENT : NAVFAC

PROJECT : CTO-14

LOCATION : UXO-02, Camp Lejeune, NC

ELEVATION : 33.96 ft msl

DRILLING CONTRACTOR : Probe Technologies

COORDINATES : 3828672.7 N 277453.6 E

DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers

WATER LEVEL: 6.73 ft btoc

START : 3/26/2010

END : 3/26/2010

LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
	0.0			0 ppm		SILTY SAND (SM) tan, moist, loose.	0ft: Bentonite granules
		5.0	HA-1				2ft: 20/30 Silica sand pack
5	5.0			0 ppm		POORLY GRADED SAND (SP) tan, wet, loose.	3ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
		3.0	DP-1			No recovery.	
10	10.0			0 ppm		POORLY GRADED SAND (SP) tan, wet, loose.	
		5.0	DP-2				
15	15.0					SANDY LEAN CLAY (CL) gray, wet, very soft.	13ft: Bottom of well
20							
25							

FID: Flame ionization detector



PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW26
SHEET 1 OF 1	
<h2 style="margin: 0;">Soil Boring Log</h2>	

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 31.12 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3828609.5 N 277374.5 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 3.5 ft btoc	START : 3/26/2010	END : 3/26/2010
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION <small>SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY</small>	WELL DETAILS
	0.0			0 ppm		SILTY SAND (SM) brown, very moist, loose.	0ft: Bentonite granules
		5.0	HA-1			SILTY SAND (SM) brown, wet, loose.	1ft: 20/30 Silica sand pack
5	5.0			0 ppm		No recovery.	2ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
		2.0	DP-1				
10	10.0			0 ppm		SILTY SAND (SM) brown, wet, loose.	
		2.0	DP-2			No recovery.	12ft: Bottom of well
15	15.0						
20							
25							

FID: Flame ionization detector



Prepared By: Susan Forker
Checked By: Simon Kline

PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW27
SHEET 1 OF 1	
<h2 style="margin: 0;">Soil Boring Log</h2>	

CLIENT : NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 35.22 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3828633.6 N 277558.6 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 4.51 ft btoc	START : 3/25/10 08:53	END : 3/25/10 08:53
	LOGGER : J Albano	

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
5	0.0	5.0	HA-1	0 ppm		POORLY GRADED SAND (SP) tan, moist, loose.	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">0ft: Bentonite granules</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">1ft: 20/30 Silica sand pack</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">2ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack</div>
	5.0			0 ppm		CLAYEY SAND (SC) tannish orange, very moist, loose.	
		4.0	DP-1	0 ppm		POORLY GRADED SAND (SP) tan, wet, loose.	
				0 ppm		SILTY SAND (SM) brown, wet, loose. No recovery.	
10	10.0	4.0	DP-2	0 ppm		SILTY SAND (SM) brown, wet, loose.	
				0 ppm		SILTY SAND (SM) tan, wet, loose.	
				0 ppm		CLAYEY SAND (SC) gray, wet, loose. No recovery.	
15	15.0						12ft: Bottom of well
20							
25							

FID: Flame ionization detector



PROJECT NUMBER: 378849.SI.FK	BORING NUMBER: MR02-TW28	SHEET 1 OF 1
<h2>Soil Boring Log</h2>		

CLIENT: NAVFAC	PROJECT : CTO-14	LOCATION : UXO-02, Camp Lejeune, NC
ELEVATION : 25.81 ft msl	DRILLING CONTRACTOR : Probe Technologies	
COORDINATES : 3828724.8 N 277551.9 E	DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers	
WATER LEVEL: 5.45 ft btoc	START : 3/25/2010	END : 3/25/2010
		LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
5	0.0		HA-1	0 ppm		POORLY GRADED SAND (SP) tan, very moist, loose.	0ft: Bentonite granules
	5.0	5.0					2ft: 20/30 Silica sand pack
			DP-1	0 ppm		POORLY GRADED SAND (SP) tan, wet, loose.	3ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
		4.0				SANDY LEAN CLAY (CL) grayish orange, moist, medium stiff.	
10			DP-2			No recovery.	
	10.0			0 ppm		SANDY LEAN CLAY (CL) grayish orange, saturated, very soft, mottled.	
		5.0				SANDY LEAN CLAY (CL) orange, moist, medium stiff.	13ft: Bottom of well
15	15.0						
20							
25							

FID: Flame ionization detector



PROJECT NUMBER:
378849.SI.FK

BORING NUMBER:
MR02-TW29

SHEET 1 OF 1

Soil Boring Log

CLIENT: NAVFAC

PROJECT : CTO-14

LOCATION : UXO-02, Camp Lejeune, NC

ELEVATION : 33.95 ft msl

DRILLING CONTRACTOR : Probe Technologies

COORDINATES : 3828717.5 N 277620.9 E

DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers

WATER LEVEL: 6.11 ft btoc

START : 3/25/2010

END : 3/25/2010

LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
0	0.0		HA-1	0 ppm		SILTY SAND (SM) tan, moist, loose.	0ft: Bentonite granules
5	5.0	5.0	DP-1	0 ppm		SILTY SAND (SM) tan, wet, loose. SILTY SAND (SM) black, saturated, loose, trace clay.	3ft: 20/30 Silica sand pack 4ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
10	10.0		DP-2	0 ppm		No recovery.	
15	15.0						14ft: Bottom of well
20							
25							

FID: Flame ionization detector



PROJECT NUMBER:
378849.SI.FK

BORING NUMBER:
MR02-TW30

SHEET 1 OF 1

Soil Boring Log

CLIENT : NAVFAC

PROJECT : CTO-14

LOCATION : UXO-02, Camp Lejeune, NC

ELEVATION : 7.98 ft msl

DRILLING CONTRACTOR : Probe Technologies

COORDINATES : 3828654.6 N 277736.3 E

DRILLING METHOD AND EQUIPMENT : DPT with Geoprobe 7720DT, Macro-core samplers

WATER LEVEL: 6.1 ft btoc

START : 3/25/2010

END : 3/25/2010

LOGGER : J Albano

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	Sample ID	FID SCREENING LEVELS	GRAPHIC LOG	SOIL DESCRIPTION	WELL DETAILS
						SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
	0.0			0 ppm		SILTY SAND (SM) brown, moist, loose.	0ft: Bentonite granules
		5.0	HA-1			CLAYEY SAND (SC) tan and orange, moist, loose, mottled.	
5	5.0			0 ppm		CLAYEY SAND (SC) tan and orange, wet, loose, mottled.	3ft: 20/30 Silica sand pack 4ft: 1 in diameter, 0.010 in machine slotted screen with attached filter pack
		4.0	DP-1			No recovery.	
10	10.0			0 ppm		CLAYEY SAND (SC) tan and orange, wet, loose, mottled.	
		4.0	DP-2			POORLY GRADED SAND (SP) tan and orange, saturated, loose.	
15	15.0					No recovery.	14ft: Bottom of well
20							
25							

FID: Flame ionization detector

Appendix E
Groundwater Sampling Data Sheets



GROUNDWATER SAMPLING DATA SHEET

Client: NAVAC
Location: UX0-02
Event: _____
Date: 3/30/10
Weather: Sunny breezy 70

Project Number: 378849.51.FQ
Well ID: MR02-TW01
Sample ID: MR02-GW01-10A
Sampling Team: V. Cunningham / RDU
M. Smith / RDU S. Foraker / RDU

Total Depth: 12.03 FT.(BTOC)
Depth to water: (-) 3.53 FT.(BTOC)
Water Column: 8.5 FT.
(x) 0.041 GAL/FT.
Well Volume: 0.349 GAL. $\times 3 = 1.05$
Total Purge Vol.: 1.2 GAL.

Measuring Device: YSI 556 # 15006
Date and Time: Hanna turbidity # 09008
3/30/10, see table

Purge Device: peristaltic pump

Well Dia. (inches)	Volume (gallons/foot)
<u>1</u>	<u>0.041</u>
1.25	0.064
2	0.163
4	0.653

SAMPLE DATA

Date: <u>3/30/10</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(ft)</u>	Color / Odor / Comments
Time: <u>1320</u>								
Method: <u>low-flow</u>	<u>14.81</u>	<u>0.354</u>	<u>0.77</u>	<u>6.01</u>	<u>127.2</u>	<u>9.18</u>	<u>3.69</u>	

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(ft)</u>	Color / Odor / Comments
<u>1255</u>	<u>0.2</u>	<u>14.48</u>	<u>0.292</u>	<u>3.30</u>	<u>5.81</u>	<u>141.8</u>	<u>109</u>	<u>3.67</u>	
<u>1300</u>	<u>0.4</u>	<u>14.76</u>	<u>0.313</u>	<u>1.69</u>	<u>5.83</u>	<u>138.8</u>	<u>64.4</u>	<u>3.67</u>	
<u>1305</u>	<u>0.6</u>	<u>14.66</u>	<u>0.334</u>	<u>1.17</u>	<u>5.92</u>	<u>133.5</u>	<u>35.5</u>	<u>3.67</u>	
<u>1310</u>	<u>0.8</u>	<u>14.73</u>	<u>0.345</u>	<u>0.96</u>	<u>5.97</u>	<u>130.8</u>	<u>18.4</u>	<u>3.68</u>	
<u>1315</u>	<u>1.0</u>	<u>14.70</u>	<u>0.350</u>	<u>0.86</u>	<u>5.99</u>	<u>128.9</u>	<u>11.8</u>	<u>3.68</u>	
<u>1320</u>	<u>1.2</u>	<u>14.81</u>	<u>0.354</u>	<u>0.77</u>	<u>6.01</u>	<u>127.2</u>	<u>9.18</u>	<u>3.69</u>	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>8330</u>	<u>None</u>	<u>1L amber</u>	<u>2</u>
<u>6850</u>	<u>None</u>	<u>250 mL poly</u>	<u>1</u>
<u>6010B</u>	<u>HNO3</u>	<u>250 mL poly</u>	<u>1</u>

Observations/Notes:

1251 - started pump
tubing set at 10'
DTW - depth to water

MS/MSD

Duplicate ID No.:

Signature(s): Vardana Gyl



GROUNDWATER SAMPLING DATA SHEET

Client: NAVEACLocation: UXO-02

Event: _____

Date: 3/30/10Weather: Sunny breezy 70sTotal Depth: 17.92 FT.(BTOC)Depth to water: (-) 9.87 FT.(BTOC)Water Column: 8.05 FT.(x) 0.041 GAL/FT.Well Volume: 0.330 GAL. X3 = 0.990Total Purge Vol.: 1.1 GAL.Purge Device: peristaltic pumpProject Number: 378849.SI.FQWell ID: MR02-TW02Sample ID: MR02-GW02-10ASampling Team: V. Cunningham/RDV, M. Smith/RDVS. Forker/RDVMeasuring Device: YSI 556 # 15006
Hanna Turbidity # 09008Date and Time: 3/30/10, see table

Well Dia. (inches)	Volume (gallons/foot)
<u>1</u>	<u>0.041</u>
1.25	0.064
2	0.163
4	0.653

SAMPLE DATA

Date: <u>3/30/10</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(ft)</u>	Color / Odor / Comments
Time: <u>1540</u>								
Method: <u>low-flow</u>	<u>17.32</u>	<u>0.335</u>	<u>0.69</u>	<u>5.06</u>	<u>94.1</u>	<u>1.40</u>	<u>11.55</u>	

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(ft)</u>	Color / Odor / Comments
<u>1515</u>	<u>0.1</u>	<u>17.23</u>	<u>0.385</u>	<u>3.97</u>	<u>5.48</u>	<u>133.6</u>	<u>26.1</u>	<u>10.91</u>	<u>clear</u>
<u>1520</u>	<u>0.3</u>	<u>17.29</u>	<u>0.374</u>	<u>2.02</u>	<u>5.29</u>	<u>115.4</u>	<u>9.95</u>	<u>11.11</u>	
<u>1525</u>	<u>0.5</u>	<u>17.43</u>	<u>0.356</u>	<u>1.15</u>	<u>5.19</u>	<u>106.5</u>	<u>4.39</u>	<u>11.21</u>	
<u>1530</u>	<u>0.7</u>	<u>17.49</u>	<u>0.351</u>	<u>0.86</u>	<u>5.14</u>	<u>100.1</u>	<u>3.09</u>	<u>11.13</u>	
<u>1535</u>	<u>0.9</u>	<u>17.38</u>	<u>0.338</u>	<u>0.79</u>	<u>5.08</u>	<u>96.4</u>	<u>2.39</u>	<u>11.36</u>	
<u>1540</u>	<u>1.1</u>	<u>17.32</u>	<u>0.335</u>	<u>0.69</u>	<u>5.06</u>	<u>94.1</u>	<u>1.40</u>	<u>11.55</u>	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>8330</u>	<u>None</u>	<u>1L amber</u>	<u>2</u>
<u>6850</u>	<u>None</u>	<u>250 mL poly</u>	<u>1</u>
<u>6010 B</u>	<u>HN03</u>	<u>250 mL poly</u>	<u>1</u>

Observations/Notes:

Started pump at 1512
tubing set at 13'
DTW - depth to water

MS/MSD

Duplicate ID No.:

Signature(s): Yard And Chris

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC

Location: UXO-02

Event: _____

Date: 3/30/10

Weather: Sunny breezy 70s

Total Depth: 14.82 FT.(BTOC)

Depth to water: (-) 5.22 FT.(BTOC)

Water Column: 9.6 FT.

(x) 0.041 GAL/FT.

Well Volume: 0.394 GAL. $\times 3 = 1.1808$

Total Purge Vol.: 1.4 GAL.

Purge Device: peristaltic pump

Project Number: 378849.SI.FG

Well ID: MR02-TW03

Sample ID: ~~MR02~~ (E) MR02-TW03-10A

Sampling Team: M. Smith / RDV, V. Cunningham / RDV
S. Forker / RDV

Measuring Device: YS1556# 15006

Date and Time: Hanna Turbidity #09008
3/30/10, see table

Well Dia. (inches)	Volume (gallons/foot)
<u>1</u>	<u>0.041</u>
1.25	0.064
2	0.163
4	0.653

SAMPLE DATA									
Date: <u>3/30/10</u>	Temp.	Cond.	DO	pH	ORP	Turbidity	Other: <u>DTW</u>	Color / Odor / Comments	
Time: <u>1435</u>	°C	mS/cm	mg/L	SU	mV	NTU	<u>(ft)</u>		
Method: <u>low-flow</u>	<u>15.32</u>	<u>0.327</u>	<u>0.65</u>	<u>5.46</u>	<u>138.7</u>	<u>9.22</u>	<u>5.37</u>		

FIELD PARAMETERS									
Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u>	Color / Odor / Comments
								<u>(ft)</u>	
<u>1405</u>	<u>0.2</u>	<u>15.11</u>	<u>0.276</u>	<u>1.48</u>	<u>5.44</u>	<u>151.9</u>	<u>41.5</u>	<u>5.41</u>	<u>clear</u>
<u>1410</u>	<u>0.4</u>	<u>15.01</u>	<u>0.293</u>	<u>1.05</u>	<u>5.41</u>	<u>150.8</u>	<u>30.5</u>	<u>5.41</u>	
<u>1415</u>	<u>0.6</u>	<u>15.06</u>	<u>0.304</u>	<u>0.85</u>	<u>5.42</u>	<u>146.1</u>	<u>16.2</u>	<u>5.36</u>	
<u>1420</u>	<u>0.8</u>	<u>15.02</u>	<u>0.310</u>	<u>0.76</u>	<u>5.43</u>	<u>143.2</u>	<u>13.8</u>	<u>5.36</u>	
<u>1425</u>	<u>1.0</u>	<u>15.04</u>	<u>0.317</u>	<u>0.66</u>	<u>5.44</u>	<u>142.0</u>	<u>12.7</u>	<u>5.37</u>	
<u>1430</u>	<u>1.2</u>	<u>15.29</u>	<u>0.321</u>	<u>0.60</u>	<u>5.45</u>	<u>141.4</u>	<u>11.4</u>	<u>5.38</u>	
<u>1435</u>	<u>1.4</u>	<u>15.32</u>	<u>0.327</u>	<u>0.65</u>	<u>5.46</u>	<u>138.7</u>	<u>9.22</u>	<u>5.37</u>	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>8330</u>	<u>None</u>	<u>1L amber</u>	<u>2</u>
<u>6850</u>	<u>None</u>	<u>250 mL poly</u>	<u>1</u>
<u>6010 B</u>	<u>HNO3</u>	<u>250 mL poly</u>	<u>1</u>

Observations/Notes:

Pump started at 1400
Tubing set at 10'
DTW - depth to water

MS/MSD

Duplicate ID No.:

Signature(s): Verdiana Cigna



CH2MHILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTO-014
 Date: 3-31-10
 Weather: Sunny 60°F

Project Number: 378849.SI.FQ
 Well ID: MK02-TW04
 Sample ID: MK02-GW04-10A
 Sampling Team: S. Foxler

Total Depth: 16.95 FT.(BTOC)
 Depth to water: (-) 8.11 FT.(BTOC)
 Water Column: 8.84 FT.
 (x) 0.041 GAL/FT.
 Well Volume: 0.35 GAL.
 Total Purge Vol.: 1.1 GAL.

Measuring Device: YSI 556 MPS
 Date and Time: 3-31-10 0830

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

Purge Device: Per pump

FIELD PARAMETERS

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		
0830	Pump on							400	Slightly cloudy
0838	8.67	15.33	0.166	2.21	5.89	173.6	50.0	350	Clear
0842	8.75	15.62	0.160	1.64	5.66	171.7	21.0	350	
0846	8.80	15.90	0.155	1.36	5.60	170.6	14.0	350	
0850	8.83	15.91	0.153	1.21	5.59	170.4	9.90	350	
0853	8.86	15.93	0.153	1.10	5.59	170.3	6.90	300	

SAMPLE DATA

Date: 3-31-10	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time: 0900								
Method: Low flow	15.94	0.152	1.08	5.59	170.5	2.90		Clear

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Total Metals	HNO3	250 mL poly	1
Explosives + PETN	<4deg C	1 L amber	1
Perchlorate	<4deg C	250 mL poly	1
Nitroglycerin	<4deg C	1 L amber	1
Dissolved Metals	HNO3	250 mL poly	X

Observations/Notes:

Total Volume Purged: 2.0

MS/MSD: YES

(NO)

Duplicate ID No.: —

Signature(s):

S. Foxler



CH2MHILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTO-014
 Date: 3/30/10
 Weather: CLOUDY, 60'S

Project Number: 378849.SI.FQ
 Well ID: MROZ-TWOG
 Sample ID: MROZ-GWOG-014
 Sampling Team: R. SMITH / RDC

Total Depth: 14.9 FT.(BTOC)
 Depth to water: (-) 6.11 FT.(BTOC)
 Water Column: 8.79 FT.
 (x) .041 GAL/FT.
 Well Volume: .36 GAL.
 Total Purge Vol.: 1.75 GAL.

Measuring Device: PSI / HANNA
 Date and Time: 3/30/10 1250

Purge Device: GERO PUMP

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

FIELD PARAMETERS

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments VOL. PURGED
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		
1312	7.30	16.17	.012	6.86	5.20	222.8	71000	300	.1
1317	9.20	15.56	.065	6.25	4.83	264.4	71000		.25
1322	10.10	15.45	.069	6.15	4.98	268.7	71000		.5
1325	11.30	15.55	.064	6.01	5.02	275.3	71000		.75
1330	12.20	15.78	.067	5.81	5.03	275.1	71000	400	1.2
1335	13.30	16.05	.066	5.53	5.06	273.0	71000	350	1.5

SAMPLE DATA

Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time:								
Method:								

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Total Metals	HNO3	250 mL poly	
Explosives + PETN	<4deg C	1 L amber	
Perchlorate	<4deg C	250 mL poly	
Nitroglycerin	<4deg C	1 L amber	
Dissolved Metals	HNO3	250 mL poly	

Observations/Notes:

Total Volume Purged: 1.75

1330 WELL GOES DR
 NO SAMPLE COLLECTED BAILER SET TO CAPTURE
 RECHARGE

3/31/10 1010 COLLECTED SAMPLE

ISD: YES

NO

Duplicate ID No.:

ture(s):

my B

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC
Location: MCB CAM LBT
Event: UO-02 BW SAMPLING
Date: 3/31/10
Weather: SUNNY 50'S

Project Number: _____
Well ID: M202-TW06
Sample ID: M202-GW08
Sampling Team: M SMITH / PDU

Total Depth:	<u>14.81</u>	FT.(BTOC)
Depth to water:	<u>(-) 5.35</u>	FT.(BTOC)
Water Column:	<u>9.46</u>	FT.
	<u>(x) .041</u>	GAL/FT.
Well Volume:	<u>388</u>	GAL.
Total Purge Vol.:	<u>60</u>	GAL.

Measuring Device: YSI HANNA
Date and Time: 3/31/10 0905

Purge Device: GEO-PUMP

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653

SAMPLE DATA

Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time:								
Method:								

FIELD PARAMETERS

[illegible]

Sample information: method, container number, size, and type, preservative used.

[illegible]

Observations/Notes:

0934 WELL GOES DRY. SET BAILER.

4/1/10 0800 COLLECTED SAMPLE

MS/MSD

Duplicate ID No.: _____

Signature(s):

8/2



GROUNDWATER SAMPLING DATA SHEET

Client: NAVFACLocation: UX0-02

Event: _____

Date: 3/30/10Weather: sunny, breezy, 60sTotal Depth: 19.8 FT.(BTOC)Depth to water: (-) 12.51 FT.(BTOC)Water Column: 7.29 FT.(x) 0.041 GAL/FT.Well Volume: 0.299 GAL. $x3 = 0.897$ Total Purge Vol.: 1.0 GAL.Purge Device: peristaltic pumpProject Number: 378849, SI. FQWell ID: MRO2-TW09Sample ID: MRO2-GW09-10ASampling Team: V. Cunningham / RDUM. Smith / RDU, S. Forker / RDUMeasuring Device: KSI 556 # 15006Date and Time: Hanna Turbidity # 090083/30/10, see table

Well Dia. (inches)	Volume (gallons/foot)
<u>1</u>	<u>0.041</u>
1.25	0.064
2	0.163
4	0.653

SAMPLE DATA

Date: <u>3/30/10</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(#)</u>	Color / Odor / Comments
Time: <u>1115</u>								
Method: <u>low-flow</u>	<u>16.89</u>	<u>0.604</u>	<u>0.96</u>	<u>4.48</u>	<u>-48.0</u>	<u>6.76</u>	<u>13.68</u>	

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(#)</u>	Color / Odor / Comments
<u>1055</u>	<u>0.2</u>	<u>16.13</u>	<u>0.702</u>	<u>4.37</u>	<u>4.94</u>	<u>128.2</u>	<u>56.7</u>	<u>13.46</u>	
<u>1100</u>	<u>0.4</u>	<u>16.49</u>	<u>0.683</u>	<u>2.57</u>	<u>4.82</u>	<u>50.1</u>	<u>34.4</u>	<u>13.52</u>	
<u>1105</u>	<u>0.6</u>	<u>16.84</u>	<u>0.628</u>	<u>1.23</u>	<u>4.62</u>	<u>-17.5</u>	<u>13.6</u>	<u>13.63</u>	
<u>1110</u>	<u>0.8</u>	<u>16.84</u>	<u>0.619</u>	<u>1.09</u>	<u>4.52</u>	<u>-36.5</u>	<u>9.69</u>	<u>13.62</u>	
<u>1115</u>	<u>1.0</u>	<u>16.89</u>	<u>0.604</u>	<u>0.96</u>	<u>4.48</u>	<u>-48.0</u>	<u>6.76</u>	<u>13.68</u>	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>8330</u>	<u>None</u>	<u>1L amber</u>	<u>2</u>
<u>6850</u>	<u>None</u>	<u>250 mL poly</u>	<u>1</u>
<u>6010B</u>	<u>HNO3</u>	<u>250 mL poly</u>	<u>1</u>

Observations/Notes:

Tubing set to 15'
Pump started at 1051
DTW - depth to water

MS/MSD

Duplicate ID No.:

Signature(s): Vendene C. Smith



GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
Location: MCB CAMP LEJEUNE
Event: CTO-014
Date: 3-31-10
Weather: Sunny 60°F

Project Number: 378849.SI.FQ
Well ID: MR02-TW10
Sample ID: MR02-GW10-10A
Sampling Team: S Forker

Total Depth: 12.75 FT.(BTOC)
Depth to water: (-) 8.28 FT.(BTOC)
Water Column: 4.47 FT.
(x) 0.041 GAL/FT.
Well Volume: 0.3 GAL.
Total Purge Vol.: 0.9 GAL.

Measuring Device: YSI 556 MPS
Date and Time: 3-31-10 0955

Purge Device: Peri pump

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

FIELD PARAMETERS

Time	Depth to Water (ft bgs)	✓Temp. °C	✓Cond. mS/cm	DO mg/L	✓pH SU	✓ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		
0955	Pump on							400	light brown
1000	11.2	13.36	0.097	5.50	4.86	174.0	220	300	
1005	11.05	13.21	0.080	3.11	4.56	188.4	750	300	
1010	10.90	13.20	0.082	2.56	4.43	202.8	750	350	
1015	11.00	13.19	0.084	2.62	4.34	213.6	500	350	
1020	11.00	13.21	0.085	3.02	4.25	223.5	360	350	
1025	11.10	13.22	0.086	2.62	4.22	230.7	290	350	
1030	11.10	13.26	0.086	2.85	4.21	235.7	250	350	
1035	11.12	13.32	0.086	3.19	4.19	240.9	260	350	
1040	11.02	13.48	0.087	3.18	4.19	244.7	330	350	

SAMPLE DATA

Date: 3-31-10	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time: 1110								
Method: Lowflow	13.61	0.086	2.51	4.46	243.4	60		

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Total Metals	HNO3	250 mL poly	
Explosives + PETN	<4deg C	1 L amber	
Perchlorate	<4deg C	250 mL poly	
Nitroglycerin	<4deg C	1 L amber	
* Dissolved Metals	HNO3	250 mL poly	

Observations/Notes:

Total Volume Purged: _____

MS/MSD: YES (NO) Duplicate ID No.: _____

Signature(s): S Forker

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC
 Location: UXO-02
 Event: _____
 Date: 3/30/10
 Weather: Sunny 55°F

Project Number: 378849.SI.FQ
 Well ID: MR02-TW11
 Sample ID: MR02-GW11-10A
 Sampling Team: V. Cunningham / RDU
M. Smith / RDU, S. Farker / RDU

Total Depth: 14.9 FT.(BTOC)
 Depth to water: (-) 8.12 FT.(BTOC)
 Water Column: 6.78 FT.
(x) 0.041 GAL/FT.
 Well Volume: 0.278 GAL. X3 = 0.834
 Total Purge Vol.: 2.1 GAL.

Measuring Device: YSI 556 #15006
Hanna Turbidity # 09008
 Date and Time: 3/30/10, see table

Purge Device: peristaltic pump

Well Dia. (inches)	Volume (gallons/foot)
<u>1</u>	<u>0.041</u>
1.25	0.064
2	0.163
4	0.653

SAMPLE DATA								
Date: <u>3/30/10</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(ft)</u>	Color / Odor / Comments
Time: <u>0915</u>								
Method: <u>low-flow</u>	<u>15.09</u>	<u>0.225</u>	<u>1.06</u>	<u>4.76</u>	<u>137.8</u>	<u>7.82</u>	<u>9.43</u>	

FIELD PARAMETERS									
Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(ft)</u>	Color / Odor / Comments
0825	0.1	14.84	0.215	5.21	5.26	154.2	149	8.97	
0830	0.3	14.89	0.218	3.15	5.14	134.7	194	9.14	
0835	0.5	14.88	0.219	2.38	5.05	126.7	73.8	9.15	
0840	0.7	14.91	0.221	1.56	4.97	127.2	42.1	9.21	
0845	0.9	14.95	0.221	1.68	4.93	128.8	29.4	9.26	
0850	1.1	14.98	0.223	1.24	4.87	132.4	24.8	9.28	
0855	1.3	15.02	0.223	1.25	4.82	134.2	23.4	9.33	
0900	1.5	15.06	0.223	1.11	4.80	135.7	23.9	9.41	
0905	1.7	15.11	0.223	1.07	4.79	135.3	30.6	9.41	
0910	1.9	15.08	0.225	1.03	4.77	135.7	13.8	9.43	
0915	2.1	15.09	0.225	1.06	4.76	137.8	7.82	9.43	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>8330</u>	<u>None</u>	<u>1L Amber</u>	<u>2</u>
<u>6850</u>	<u>None</u>	<u>250 mL poly</u>	<u>1</u>
<u>6010 B</u>	<u>HNO3</u>	<u>250 mL poly</u>	<u>1</u>

Observations/Notes:

tubing set at 12'
pump started at 0823
DTW - depth to water

MS/MSD

Duplicate ID No.:

Signature(s):

Vend Anne C. J.



Client:	NAVFAAC Mid-Atlantic	Project Number:	378849.SI.FQ
Location:	MCB CAMP LEJEUNE	Well ID:	MROZ-TW12
Event:	CTO-014	Sample ID:	MROZ-GW12-10A
Date:	3/30/10	Sampling Team:	M. SMITH / RDO
Weather:	SUNNY, 60°'s		

Total Depth:	<u>14.8</u>	FT.(BTOC)
Depth to water:	<u>(-) 11.71</u>	FT.(BTOC)
Water Column:	<u>3.09</u>	FT.
	<u>(x) 0.041</u>	GAL/FT.
Well Volume:	<u>0.127</u>	GAL.
Total Purge Vol.:		GAL.

Measuring Device: YSI / HANNA

Date and Time:

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

Purge Device: GEO. PUMP

[illegible]

Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time:								
Method:								

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Total Metals	HNO3	250 mL poly	
Explosives + PETN	<4deg C	1 L amber	
Perchlorate	<4deg C	250 mL poly	
Nitroglycerin	<4deg C	1 L amber	
Dissolved Metals	HNO3	250 mL poly	

Observations/Notes:

Total Volume Purged:

5

UNABLE TO PURGE W/ PUMP. BAILED WELL
TILL DIRT THEN SET BAILEY

3/31/10 1515 COLLECTED SAMPLE

MS/MSD: YES

NO

Duplicate ID No.:

Signature(s):



GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
Location: MCB CAMP LEJEUNE
Event: CTO-014
Date: 3-30-10
Weather: Sunny 60°F

Project Number: 378849.SI.FQ
Well ID: MR02-TW13
Sample ID: MR02-GW13-10A
Sampling Team: S Forker / RDU
M Smith / RDU

Total Depth: 14.8 FT.(BTOC)
Depth to water: (-) 5.42 FT.(BTOC)
Water Column: 9.38 FT.
(x) 0.041 GAL/FT.
Well Volume: ~0.4 GAL.
Total Purge Vol.: 5.7 GAL.

Measuring Device: YSI 556 MPS, Hanna turb
Date and Time: 3-30-10 / 0900

Purge Device: Per pump

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

FIELD PARAMETERS

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10	Vol. (L)	
0900	Start pump								Cloudy
0905	5.50	12.86	0.130	3.10	5.05	177.9	290	1.0	
0910	5.60	12.82	0.148	2.47	4.44	191.9	280	1.5	
0915	5.67	12.79	0.160	1.94	4.23	204.6	85.0	1.8	
0920	5.75	12.76	0.166	1.71	4.19	209.3	31.0	2.5	
0924	5.8	12.78	0.168	1.72	4.18	210.3	22.0	3.0	
0928	5.83	12.78	0.167	1.68	4.17	211.3	14.0	4.0	
0932	5.87	12.78	0.172	1.70	4.17	211.7	17.0	4.5	
0936		12.79	0.175	1.66	4.17	211.7	13.0	5.0	
0942		12.79	0.178	1.62	4.17	212.6	10.0	5.5	

SAMPLE DATA

Date: 3-30-10	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time: 0945								
Method: Low flow	12.79	0.178	1.62	4.17	212.6	10		Clear

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Total Metals	HNO3	250 mL poly	1
Explosives + PETN	<4deg C	1 L amber	1
Perchlorate	<4deg C	250 mL poly	1
Nitroglycerin	<4deg C	1 L amber	1
Dissolved Metals	HNO3	250 mL poly	X

Observations/Notes:

Total Volume Purged: 5.7

MS/MSD: YES ☒ Duplicate ID No.:

Signature(s): S Forker

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTO-014
 Date: 3-30-10
 Weather: Sunny 65°F

Project Number: 378849.SI.FQ
 Well ID: MR02-TW14
 Sample ID: MR02-GW14-10A
 Sampling Team: S Forker
M Smith

Total Depth: 15.0 FT.(BTOC)
 Depth to water: (-) 4.9 FT.(BTOC)
 Water Column: 5.1 FT.
(x) 0.041 GAL/FT.
 Well Volume: 0.4 GAL.
 Total Purge Vol.: 1.2 GAL.

Measuring Device: YSI MPS 556
 Date and Time: 3-30-10 1020

Purge Device: Pexi pump

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

FIELD PARAMETERS

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		
1025	Pump on								little cloudy
1030	—	13.44	0.056	2.33	4.59	204.9	400	350	
1035	—	13.33	0.055	1.82	4.61	191.5	29	350	
1040	—	13.36	0.055	1.74	4.59	186.2	13	350	
1043	—	13.36	0.055	1.79	4.57	184.1	7.4	325	
1047	—	13.47	0.055	1.80	4.53	184.6	4.7	325	
1050	—	13.44	0.055	1.84	4.53	183.8	3.7	325	

SAMPLE DATA

Date: <u>3-30-10</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time: <u>1055</u>								
Method: <u>low flow</u>	<u>13.46</u>	<u>0.055</u>	<u>1.86</u>	<u>4.54</u>	<u>180.5</u>	<u>3.7</u>		

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Total Metals	HNO3	250 mL poly	1
Explosives + PETN	<4deg C	1 L amber	1
Perchlorate	<4deg C	250 mL poly	1
Nitroglycerin	<4deg C	1 L amber	1
Dissolved Metals	HNO3	250 mL poly	X

Observations/Notes:

Total Volume Purged: _____

Water level meter battery died, drawdown in this well was very small during development. New battery is on the way.

MS/MSD: YES (NO) Duplicate ID No.: _____

Signature(s): S Forker



Project Number: 378849.S1 - EQ
Well ID: MRO2 - TW15
Sample ID: MRO2 - GW15 - 10A
Sampling Team: V. Cunningham / RDU
M. Smith / RDU

Measuring Device: YSI 556# 68988 1500L
Date and Time: Hanna Turbidity #08988

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653

[illegible]

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
8330	None	1L Amber	2
6850	None	250mL poly	1
6010B	HNO3	250 mL poly	1

Observations/Notes:

Started pump @ 1537
Tubing set at 10'

* specific conductance readings began jumping sporadically

1550 well going dry - lowered tubing to bottom of well

MS/MSD

Duplicate ID No.: MRGZ-GWISD-10A @ 1620

Signature(s):

Verd Ana Cruz



Project Number: 37889.FF.SQ
Well ID: MROZ-TW10
Sample ID: MROZ-GW10-10A
Sampling Team: R. SMITH
C. WILDER

Measuring Device: YSI / HANNA
Date and Time: 3/31/10 0815

Purge Device: GEO PUMP

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653

SAMPLE DATA								
Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time:								
Method:								

[illegible]

Sample information: method, container number, size, and type, preservative used.

[illegible]

Observations/Notes:

36.42 0877 WFL - GOES DRY. SET BAILER
4/1/10 0830 COLLECTED SAMPLE

MS/MSD

Duplicate ID No.:

Signature(s):

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTO-014
 Date: 3-29-10
 Weather: 65°F, rain

Project Number: 378849.SI.FQ
 Well ID: M602-TW17
 Sample ID: M602-GW17-10
 Sampling Team: S. Forker

Total Depth: 15.1 FT.(BTOC)
 Depth to water: (-) 8.07 FT.(BTOC)
 Water Column: 6.93 FT.
 (x) 0.041 GAL/FT.
 Well Volume: ~0.3 GAL.
 Total Purge Vol.: 0.4 GAL.

Measuring Device: YSI & Hannah Turb.
 Date and Time: 3/29/10 11:20
Sampled 3-30-10, 0815

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

Purge Device: Peri pump

FIELD PARAMETERS

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		
1120	9.0								
1140	Dry								Vol. ~ 0.4 gal
1210	14.5	15.10	0.381	8.97	7.73	187.7	230		Not enough water to get YSI readings (S+)
1235	14.3						75		Not enough water to get YSI readings
WELL DRY - COME BACK LATER TO SAMPLE									

SAMPLE DATA

Date: <u>3-30-10</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time: <u>0815</u>								
Method: <u>Low flow</u>	<u>not enough</u>							

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Total Metals	HNO3	250 mL poly	1
Explosives + PETN	<4deg C	1 L amber	1
Perchlorate	<4deg C	250 mL poly	1 (~60mL)
Nitroglycerin	<4deg C	1 L amber	
Dissolved Metals	HNO3	250 mL poly	*

Observations/Notes:

Total Volume Purged: ~ 1 gal
Go back & collect dissolved metals sample

MS/MSD: YES NO Duplicate ID No.:

Signature(s): S. Forker



GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC
Location: VX0-02
Event:
Date: 3/29/10
Weather: Rain, 60s

Project Number: 378849.SL.FG
Well ID: MR02-TW18
Sample ID: MR02-TW18-10A
Sampling Team: V. Cunningham / RDU
M. Smith / RDU

Total Depth: 14.8 FT.(BTOC)
Depth to water: (1) 3.86 FT.(BTOC)
Water Column: 10.94 FT.
(X) 10.94 GAL/FT.
Well Volume: 0.4148 GAL. $\times 3 = 1.35$
Total Purge Vol.: GAL.

Measuring Device: 151556 15000
Hanna Turbidity 08988
Date and Time:

Purge Device: peristaltic pump

Well Dia. (inches)	Volume (gallons/foot)
<u>1</u>	<u>0.041</u>
1.25	0.064
2	0.163
4	0.653

SAMPLE DATA

Date: <u>3/29/10</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(set)</u>	Color / Odor / Comments
Time:								
Method: <u>low-flow</u>	<u>13.41</u>	<u>0.198</u>	<u>5</u>					

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(set)</u>	Color / Odor / Comments
1000	0.3	13.41	0.198	5.24	5.51	196.5	>1000	4.23	cloudy, opaque
1010	0.4	13.22	0.174	5.73	5.56	199.3	950	4.33	"
1020	1.3	13.15	0.147	5.29	5.48	201.9	650	4.36	cloudy
1030	1.7	13.11	0.132	4.56	5.34	208.2	450	4.42	"
1040	2.5	13.15	0.127	3.98	5.25	213.4	380	4.46	
1050	2.9	13.18	0.122	3.55	5.22	216.6	390	4.48	
1100	3.3	13.25	0.119	3.23	5.22	213.0	360	4.41	
1110	3.9	13.22	0.117	3.09	5.25	213.2	330	4.41	
1120	4.5	13.17	0.113	3.74	5.22	217.4	320	4.43	
1130	5.0	13.22	0.114	2.65	5.21	217.6	380	4.45	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
8330	None	1L Amber	2
6850	None	250ml poly	1
6010B	HNO ₃	250ml poly	1

Observations/Notes:

Started pump @ 0955
turbidity set at 12'
1115 emptied flow-through cell
Stopped pump @ 1130 - turbidity stabilized too high to collect sample
DTW - depth to water

MS/MSD

Duplicate ID No.:

Signature(s):

GROUNDWATER SAMPLING DATA SHEET

Client: NAVEAC
 Location: UXO-02
 Event: _____
 Date: 3/31/10
 Weather: Sunny 50s

Project Number: 378849.SI.FG
 Well ID: MR02-TW18
 Sample ID: MR02-GW18-10A
 Sampling Team: V. Cunningham/RDU, M. Smith/RDU
S. Forker/RDU

Total Depth: 14.8 FT.(BTOC)
 Depth to water: (-) 4.52 FT.(BTOC)
 Water Column: 10.28 FT.
(x) 0.041 GAL/FT.
 Well Volume: 0.421 GAL. $\times 3 = 1.264$
 Total Purge Vol.: 2.9 GAL.

Measuring Device: YS1556 # 15006
Hanna Turbidity # 09008
 Date and Time: 3/31/10, see table

Purge Device: peristaltic pump

Well Dia. (inches)	Volume (gallons/foot)
<u>1</u>	<u>0.041</u>
1.25	0.064
2	0.163
4	0.653

SAMPLE DATA								
Date: <u>3/31/10</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(ft)</u>	Color / Odor / Comments
Time: <u>1005</u>								
Method: <u>low-flow</u>	<u>13.44</u>	<u>0.102</u>	<u>1.62</u>	<u>5.12</u>	<u>175.1</u>	<u>13.1</u>	<u>5.12</u>	

FIELD PARAMETERS									
Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(ft)</u>	Color / Odor / Comments
<u>0855</u>	<u>0.1</u>	<u>12.66</u>	<u>0.123</u>	<u>8.84</u>	<u>5.55</u>	<u>166.5</u>	<u>212</u>	<u>4.94</u>	
<u>0900</u>	<u>0.3</u>	<u>12.68</u>	<u>0.173</u>	<u>2.35</u>	<u>5.61</u>	<u>160.7</u>	<u>798</u>	<u>5.16</u>	
<u>0905</u>	<u>0.5</u>	<u>12.90</u>	<u>0.169</u>	<u>1.65</u>	<u>5.65</u>	<u>163.0</u>	<u>>1000</u>	<u>5.21</u>	
<u>0910</u>	<u>0.7</u>	<u>12.89</u>	<u>0.159</u>	<u>1.58</u>	<u>5.62</u>	<u>163.3</u>	<u>>1000</u>	<u>5.19</u>	
<u>0915</u>	<u>0.9</u>	<u>12.89</u>	<u>0.136</u>	<u>1.66</u>	<u>5.52</u>	<u>165.4</u>	<u>71000</u>	<u>5.26</u>	
<u>0925</u>	<u>1.3</u>	<u>13.02</u>	<u>0.118</u>	<u>1.49</u>	<u>5.31</u>	<u>170.9</u>	<u>113</u>	<u>5.28</u>	
<u>0935</u>	<u>1.7</u>	<u>12.97</u>	<u>0.111</u>	<u>1.53</u>	<u>5.24</u>	<u>170.5</u>	<u>50.2</u>	<u>5.35</u>	
<u>0945</u>	<u>2.1</u>	<u>13.06</u>	<u>0.106</u>	<u>1.53</u>	<u>5.17</u>	<u>171.7</u>	<u>25.0</u>	<u>5.34</u>	
<u>0955</u>	<u>2.5</u>	<u>13.14</u>	<u>0.104</u>	<u>1.61</u>	<u>5.15</u>	<u>172.1</u>	<u>16.4</u>	<u>5.35</u>	
<u>1005</u>	<u>2.9</u>	<u>13.44</u>	<u>0.102</u>	<u>1.62</u>	<u>5.12</u>	<u>175.1</u>	<u>13.1</u>	<u>5.12</u>	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>8330</u>	<u>None</u>	<u>1L amber</u>	<u>2</u>
<u>6850</u>	<u>None</u>	<u>250 mL poly</u>	<u>1</u>
<u>6010B</u>	<u>HNO3</u>	<u>250 mL poly</u>	<u>2</u>

Observations/Notes:

started pump at 0852 turbidity went back up while sampling: 74.0 NTU
tubing set at 10'
DTW - depth to water

MS/MSD

Duplicate ID No.:

Signature(s): Verd Ave Cign



Client:	NAUFAC	Project Number:	
Location:	UXO-02	Well ID:	TW19-10
Event:	GW SAMPLING	Sample ID:	
Date:	3/29/10	Sampling Team:	M SMITH / RDV
Weather:	RAIN/USD'S		

Total Depth:	<u>14.81</u>	FT.(BTOC)
Depth to water:	<u>(-) 6.40</u>	FT.(BTOC)
Water Column:	<u>8.41</u>	FT.
	<u>(x) .041</u>	GAL/FT.
Well Volume:	<u>.34481</u>	GAL.
Total Purge Vol.:		GAL.

Measuring Device: YSI/HANNA
Date and Time: 3/29/10 0940

Purge Device: GEO PUMP

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653

Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time:								
Method:								

[illegible]

Sample information: method, container number, size, and type, preservative used.

[illegible]

Observations/Notes:

MS/MSD

Duplicate ID No.:

Signature(s):

GROUNDWATER SAMPLING DATA SHEET

Location: NAVFAC
UXO-02

Project Number: 378849 SI.FQ

Well ID: MROZ-TW20

Sample ID: MROZ-GW20-10A

Sampling Team: V. Cunningham / RDU

Date: 3/29/10
 Weather: cloudy/rainy, 60

Measuring Device: YSI 556 1500C

Date and Time: Hanna Turbidity #09988
3/29/10 1335

Depth: 14.90 FT.(BTOT)

Depth to water: (1) 3.32 FT.(BTOT)

Water Column: 11.58 FT.

(X) 0.041 GAL/FT.

Well Volume: 0.475 GAL. $\times 3 = 1.424$

Total Purge Vol.: 6.0 GAL.

Purge Device: peristaltic pump

Well Dia. (inches)	Volume (gallons/foot)
<u>1</u>	<u>0.041</u>
1.25	0.064
2	0.163
4	0.653

SAMPLE DATA

Date: <u>3/29/10</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(CH)</u>	Color / Odor / Comments
Time: <u>1335</u>								
Method: <u>low-flow</u>	<u>14.38</u>	<u>0.084</u>	<u>1.12</u>	<u>4.17</u>	<u>216.4</u>	<u>23.0</u>	<u>3.76</u>	

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(CH)</u>	Color / Odor / Comments
<u>1200</u>	<u>0.4</u>	<u>13.96</u>	<u>0.106</u>	<u>1.54</u>	<u>5.04</u>	<u>215.2</u>	<u>100</u>	<u>3.67</u>	<u>cloudy</u>
<u>1210</u>	<u>1.2</u>	<u>14.06</u>	<u>0.092</u>	<u>1.26</u>	<u>4.59</u>	<u>214.0</u>	<u>85.0</u>	<u>3.67</u>	
<u>1220</u>	<u>2.0</u>	<u>14.13</u>	<u>0.091</u>	<u>1.19</u>	<u>4.90</u>	<u>217.8</u>	<u>55.0</u>	<u>3.73</u>	
<u>1230</u>	<u>2.6</u>	<u>14.18</u>	<u>0.089</u>	<u>1.25</u>	<u>4.85</u>	<u>219.4</u>	<u>38.0</u>	<u>3.75</u>	
<u>1240</u>	<u>3.2</u>	<u>14.19</u>	<u>0.086</u>	<u>1.27</u>	<u>4.77</u>	<u>223.1</u>	<u>27.0</u>	<u>3.78</u>	
<u>1250</u>	<u>3.8</u>	<u>14.16</u>	<u>0.085</u>	<u>1.29</u>	<u>4.72</u>	<u>224.4</u>	<u>27.0</u>	<u>3.79</u>	
<u>1300</u>	<u>4.4</u>	<u>14.13</u>	<u>0.084</u>	<u>1.21</u>	<u>4.60</u>	<u>226.4</u>	<u>23.0</u>	<u>3.78</u>	
<u>1315</u>	<u>4.8</u>	<u>14.17</u>	<u>0.084</u>	<u>1.16</u>	<u>4.66</u>	<u>226.0</u>	<u>24.0</u>	<u>3.76</u>	
<u>1325</u>	<u>5.2</u>	<u>14.29</u>	<u>0.085</u>	<u>1.17</u>	<u>4.19</u>	<u>216.6</u>	<u>23.0</u>	<u>3.73</u>	
<u>1335</u>	<u>6.0</u>	<u>14.38</u>	<u>0.084</u>	<u>1.12</u>	<u>4.17</u>	<u>216.4</u>	<u>23.0</u>	<u>3.76</u>	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>8330</u>	<u>None</u>	<u>250 mL Amber</u>	<u>2</u>
<u>6850</u>	<u>None</u>	<u>250 mL poly</u>	<u>1</u>
<u>6010 B</u>	<u>HNO3</u>	<u>250 mL poly</u>	<u>1</u>

Observations/Notes:

1154 - started pump
tubing set @ 10'
DTW - depth to water
turbidity stabilized at 23 NTU

MS/MSD

Duplicate ID No.: MROZ-GW20D-10A @ 1340

Signature(s): Vend Anne C. J.



GROUNDWATER SAMPLING DATA SHEET

Client: NAUPAC
 Location: MCR CAMLES
 Event: 070-02 SAMPLING
 Date: 3/24/10
 Weather: CLOUDY, 50'S

Project Number: _____
 Well ID: MRO2-TW21
 Sample ID: MRO2-GW21-10A
 Sampling Team: MSMCTH IRDU

Total Depth: 14.8 FT.(BTOT)
 Depth to water: (-) 7.41 FT.(BTOT)
 Water Column: 7.39 FT.
 (x) .641 GAL/FT.
 Well Volume: .303 GAL.
 Total Purge Vol.: _____ GAL.

Measuring Device: YSI / HANNA
 Date and Time: 3/24/10 1240

Purge Device: GEO PUMP

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653

SAMPLE DATA

Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time:								
Method:								

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u>	Color / Odor / Comments
1240	.3	13.79	.072	18.25	4.47	92.1	131	8.30	
1255	1	13.61	.069	3.21	4.46	89.8	202	8.30	
1300	1.5	13.65	.057	2.06	4.46	6.8	54.8	8.30	
1305	2.0	13.65	.057	1.90	4.42	9.1	29.8	8.30	
1310	2.5	13.64	.067	1.72	4.47	-5.3	28.8	8.30	
1315	3.0	13.60	.067	1.73	4.46	-10.2	19.3	8.30	
1320	3.5	13.63	.067	1.63	4.45	-11.3	15.1	8.30	
1325	4.0	13.66	.068	1.57	4.46	-16.8	16.9	8.30	
1330	4.3	13.69	.068	1.52	4.46	-15.7	8.37	8.30	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>METALS</u>	<u>HNO₃</u>		
<u>EXPLOSIVES</u>	<u>---</u>		
<u>NITROGLYCERIN</u>	<u>---</u>		
<u>PETN</u>	<u>---</u>		
<u>PERCHLORATE</u>	<u>---</u>		

Observations/Notes:

MS/MSD

Signature(s):

Duplicate ID No.: MRO2-GW21-D-10A



CH2MHILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTO-014
 Date: 3-29-10
 Weather: Sunny 68°F

Project Number: 378849.SI.FQ
 Well ID: M802-TW22
 Sample ID: M802-GW22-10A
 Sampling Team: S. Forker

Total Depth: 15.10 FT.(BTOC)
 Depth to water: (-) 5.51 FT.(BTOC)
 Water Column: 9.59 FT.
 (x) 0.041 GAL/FT.
 Well Volume: 0.4 GAL.
 Total Purge Vol.: 5.2 GAL.

Measuring Device: YSI 556 mPS
 Date and Time: 3-29-10 1540

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

Purge Device: Peristaltic pump

FIELD PARAMETERS

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10	Vol. (gal)	
1543	Start pump								Dark brown, cloudy
1546	5.56	14.15	0.117	2.80	4.90	122.0	>999	0.5	
1555	5.59	13.71	0.129	3.28	5.33	124.9	>999	0.9	
1600	5.62	14.05	0.127	3.12	5.35	130.3	>999	1.5	
1610	5.58	14.24	0.116	2.61	5.14	143.1	450	2.2	
1615	5.58	14.05	0.108	2.20	4.95	147.3	370	2.5	
1620	5.56	13.99	0.104	1.94	4.86	148.3	310	2.7	
1628	5.60	13.94	0.100	1.61	4.72	150.3	310	3.1	
1635	5.57	14.00	0.097	1.44	4.62	150.9	240	3.9	
1643	5.56	13.76	0.096	1.59	4.54	151.8	210	4.4	

SAMPLE DATA

Date: 3-29-10	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: Vol.	Color / Odor / Comments
Time: 1655								
Method: Low flow	13.66	0.093	1.09	4.48	152.2	200	5.2	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Total Metals	HNO3	250 mL poly	1
Explosives + PETN	<4deg C	1 L amber	1
Perchlorate	<4deg C	250 mL poly	1
Nitroglycerin	<4deg C	1 L amber	1
Dissolved Metals	HNO3	250 mL poly	1
Total			5

Observations/Notes:

Total Volume Purged: 5.2

MS/MSD: YES (NO)

Duplicate ID No.:

Signature(s): S. Forker

Time	DTW	Temp	Cond.	DO	pH	ORP	Turb	Vol	Comments
1648	5.55	13.70	0.094	1.20	4.51	152.1	220	5.0	

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTO-014
 Date: 3-30-10
 Weather: Sunny 70°F

Project Number: 378849.SI.FQ
 Well ID: MR02-TW23
 Sample ID: MR02-GW23-10A
 Sampling Team: S Forker

Total Depth: 12.2 FT.(BTOC)
 Depth to water: (-) 3.9 FT.(BTOC)
 Water Column: 8.7 FT.
(X) 0.041 GAL/FT.
 Well Volume: 0.4 GAL.
 Total Purge Vol.: 1.2 GAL.

Measuring Device: YSI 556 MPS / Hannah Turb
 Date and Time: 3-30-10 1130

Purge Device: Peri pump

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

FIELD PARAMETERS

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		
1135	<u>pump on</u>								<u>light brown</u>
1140		<u>14.96</u>	<u>0.067</u>	<u>2.72</u>	<u>4.10</u>	<u>189.0</u>	<u>260</u>	<u>400</u>	
1145	<u>4.4</u>	<u>14.77</u>	<u>0.067</u>	<u>1.61</u>	<u>4.15</u>	<u>165.0</u>	<u>200</u>	<u>300</u>	
1150	<u>4.45</u>	<u>14.77</u>	<u>0.066</u>	<u>1.18</u>	<u>4.16</u>	<u>148.6</u>	<u>130</u>	<u>300</u>	
1155		<u>14.65</u>	<u>0.066</u>	<u>1.13</u>	<u>4.17</u>	<u>135.4</u>	<u>110</u>	<u>300</u>	
1200		<u>14.56</u>	<u>0.066</u>	<u>1.12</u>	<u>4.16</u>	<u>132.1</u>	<u>90</u>	<u>300</u>	
1205		<u>14.50</u>	<u>0.065</u>	<u>1.09</u>	<u>4.15</u>	<u>130.8</u>	<u>70</u>	<u>300</u>	
1210		<u>14.42</u>	<u>0.066</u>	<u>1.06</u>	<u>4.15</u>	<u>129.7</u>	<u>60</u>	<u>300</u>	
1215		<u>14.43</u>	<u>0.066</u>	<u>1.08</u>	<u>4.14</u>	<u>129.4</u>	<u>50</u>	<u>300</u>	
1220		<u>14.44</u>	<u>0.066</u>	<u>1.01</u>	<u>4.13</u>	<u>129.1</u>	<u>55</u>	<u>300</u>	<u>SEE BACK</u>

SAMPLE DATA

Date: <u>3-30-10</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time: <u>1245</u>								
Method: <u>low flow</u>	<u>14.70</u>	<u>0.067</u>	<u>1.04</u>	<u>4.11</u>	<u>131.5</u>	<u>29</u>		

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Total Metals	HNO3	250 mL poly	1
Explosives + PETN	<4deg C	1 L amber	1
Perchlorate	<4deg C	250 mL poly	1
Nitroglycerin	<4deg C	1 L amber	1
Dissolved Metals	HNO3	250 mL poly	1

Observations/Notes:

Total Volume Purged: 4.5 gal

MS/MSD: YES ☒ NO ☐ Duplicate ID No.: _____

Signature(s): S Forker

Time	DTW	Temp	Cond	DO	pH	ORP	Turb	Rate	Comments
1225		14.51	0.066	1.05	4.12	132.0	45	300	
1228		14.62	0.067	1.04	4.12	133.7	40	300	
1233		14.61	0.067	1.04	4.11	131.4	32	300	
1240		14.73	0.067	1.05	4.11	131.0	29	300	

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC
 Location: UX8-02
 Event: _____
 Date: 3/31/10
 Weather: Sunny 70

Project Number: 378849.SI.FG
 Well ID: MR02-TW24
 Sample ID: MR02-GW24-10A
 Sampling Team: V. Cunningham/RDU, M. Smith/RDU
S. Foraker/RDU

Total Depth: 14.9 FT.(BTOC)
 Depth to water: (-) 5.44 FT.(BTOC)
 Water Column: 9.46 FT.
(x) 0.041 GAL/FT.
 Well Volume: 0.388 GAL. $\times 3 = 1.164$
 Total Purge Vol.: 1.8 GAL.

Measuring Device: YSI 556 # 15006
Hanna Turbidity # 09008
 Date and Time: 3/31/10, see table

Purge Device: peristaltic pump

Well Dia. (inches)	Volume (gallons/foot)
<u>1</u>	<u>0.041</u>
1.25	0.064
2	0.163
4	0.653

SAMPLE DATA								
Date: <u>3/31/10</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(#)</u>	Color / Odor / Comments
Time: <u>1315</u>								
Method: <u>low-flow</u>	<u>15.31</u>	<u>0.139</u>	<u>2.56</u>	<u>5.21</u>	<u>-3.8</u>	<u>650</u>	<u>14.04</u>	
FIELD PARAMETERS								
Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(#)</u>
<u>1140</u>	<u>0.2</u>	<u>15.54</u>	<u>0.146</u>	<u>4.12</u>	<u>5.61</u>	<u>67.1</u>	<u>779</u>	<u>9.57</u>
<u>1145</u>	<u>0.4</u>	<u>15.02</u>	<u>0.132</u>	<u>3.58</u>	<u>5.48</u>	<u>53.3</u>	<u>588</u>	<u>10.48</u>
<u>1150</u>	<u>0.6</u>	<u>14.79</u>	<u>0.153</u>	<u>3.52</u>	<u>5.42</u>	<u>4.1</u>	<u>71000</u>	<u>12.13</u>
<u>1200</u>	<u>1.0</u>	<u>15.40</u>	<u>0.157</u>	<u>2.98</u>	<u>5.41</u>	<u>-13.4</u>	<u>954</u>	<u>—</u>
<u>1235</u>	<u>1.2</u>	<u>15.86</u>	<u>0.130</u>	<u>3.27</u>	<u>5.23</u>	<u>21.5</u>	<u>87.0</u>	<u>8.85</u>
<u>1240</u>	<u>1.5</u>	<u>15.24</u>	<u>0.132</u>	<u>2.60</u>	<u>5.13</u>	<u>30.9</u>	<u>209</u>	<u>11.38</u>
<u>1245</u>	<u>1.8</u>	<u>15.31</u>	<u>0.139</u>	<u>2.56</u>	<u>5.21</u>	<u>-3.8</u>	<u>650</u>	<u>14.04</u>

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>8330</u>	<u>None</u>	<u>1L amber</u>	<u>2</u>
<u>8650</u>	<u>None</u>	<u>250 mL poly</u>	<u>1</u>
<u>8010 B</u>	<u>HNO3</u>	<u>250 mL poly</u>	<u>2</u>

Observations/Notes:

Started pump at 1137

Tubing set at 10'

DTW - depth to water

Well going dry at 1145 - pump set to bottom of well

1200 - well went dry, stopped pump to let recharge

1230 - started purging again DTW: 5.29 ft

1248 - Well went dry, will let recharge then sample

slowest speed, tubing moved to Turbidity at beginning of collecting sample: 30.7 NTU

1315 Collected sample including dissolved metals

MS/MSD

Duplicate ID No.:

Signature(s): Vandana Singh

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC
 Location: UXO-02
 Event: _____
 Date: 3/31/10
 Weather: Sunny low 70s

Project Number: 378849.51.FQ
 Well ID: MR02-TW25
 Sample ID: MR02-GW25-10A
 Sampling Team: V. Cunningham/RDV, M. Smith/RDV
S. Foraker/RDV

Total Depth: 14.81 FT.(BTOC)
 Depth to water: (-) 6.73 FT.(BTOC)
 Water Column: 8.08 FT.
(x) 0.041 GAL/FT.
 Well Volume: 0.331 GAL. $X3 = 0.994$
 Total Purge Vol.: 0.5 GAL.

Measuring Device: YSI 556 # 15006
 Date and Time: Hanna Turbidity # 09008
3/31/10, see table

Well Dia. (inches)	Volume (gallons/foot)
<u>1</u>	<u>0.041</u>
1.25	0.064
2	0.163
4	0.653

Purge Device: peristaltic pump

SAMPLE DATA								
Date: <u>3/31/10</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW (H)</u>	Color / Odor / Comments
Time: <u>1520</u>								
Method: <u>low-flow</u>	<u>15.18</u>	<u>0.187</u>	<u>3.41</u>	<u>5.82</u>	<u>74.2</u>	<u>369</u>	<u>14.38</u>	

FIELD PARAMETERS									
Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(H)</u>	Color / Odor / Comments
1425	0.1	16.04	0.182	5.33	6.00	72.0	21.0	8.92	clear
1430	0.3	15.55	0.169	4.44	5.79	84.0	23.2	11.13	
1435	0.5	15.18	0.187	3.41	5.82	74.2	369	14.38	cloudy

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>8330</u>	<u>None</u>	<u>1 L amber</u>	<u>2</u>
<u>6850</u>	<u>None</u>	<u>250 mL poly</u>	<u>1</u>
<u>6010B</u>	<u>HNO3</u>	<u>250 mL poly</u>	<u>2</u>

Observations/Notes:

Started pump at 1422
 tubing set at 8' - moved down as water column decreased
 DTW - depth to water
 well went dry at 1437 will let recharge then sample

MS/MSD

Duplicate ID No.:

Signature(s): Vend Area Cig



CH2MHILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTO-014
 Date: 3-30-10
 Weather: Sunny 70°F

Project Number: 378849.SI.FQ
 Well ID: MR02-TW26
 Sample ID: MR02-GW26-10A
 Sampling Team: J Forker

Total Depth: 13 FT.(BTOC)
 Depth to water: (-) 3.50 FT.(BTOC)
 Water Column: 9.5 FT.
 (x) 0.041 GAL/FT.
 Well Volume: 0.4 GAL.
 Total Purge Vol.: 1.2 GAL.

Measuring Device: YSI 556 MPS
 Date and Time: 3-30-10 1350

Purge Device: Per pump

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

FIELD PARAMETERS

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		
1350	Pump on								
1359	3.60	14.13	0.073	1.27	4.34	147.8	500	450	
1405	3.6	13.93	0.069	0.63	4.39	160.4	290	400-350 sp	
1410	3.68	14.17	0.074	0.45	4.36	148.1	240	350	
1415	3.7	14.17	0.085	0.49	4.33	133.3	200	300	
1420	3.54	14.22	0.094	0.42	4.30	121.8	180	300	
1425	3.55	14.18	0.098	0.39	4.29	116.6	170	300	
1430	3.55	14.22	0.103	0.35	4.25	115.1	160	300	
1435	3.55	14.27	0.108	0.33	4.23	113.7	150	300	

SAMPLE DATA

Date: 3-30-10	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time: 1445								
Method: Low flow	14.21	0.114	0.28	4.20	111.9	130		

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Total Metals	HNO3	250 mL poly	1
Explosives + PETN	<4deg C	1 L amber	1
Perchlorate	<4deg C	250 mL poly	1
Nitroglycerin	<4deg C	1 L amber	1
Dissolved Metals	HNO3	250 mL poly	1

Observations/Notes:

Total Volume Purged: 3.5

MS/MSD: YES NO Duplicate ID No.: _____

Signature(s): J Forker



GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC
Location: UXO-02
Event: _____
Date: 3/31/10
Weather: Sunny, low 70s

Project Number: 378849, SI, FG
Well ID: MROZ - MW27
Sample ID: MROZ - GW27-10A
Sampling Team: V. Cunningham/RDU, M. Smith/RDU
S. Farker/RDU

Total Depth: 13.24 FT.(BTOC)
Depth to water: (1) 4.51 FT.(BTOC)
Water Column: 8.73 FT.
(x) 0.041 GAL/FT.
Well Volume: 0.358 GAL. $\lambda 3 = 1.074$
Total Purge Vol.: 1.6 GAL.

Measuring Device: YSI 556 # 15006
Hanna Turbidity # 09008
Date and Time: 3/31/10, see table

Purge Device: peristaltic pump

Well Dia. (inches)	Volume (gallons/foot)
<u>1</u>	<u>0.041</u>
1.25	0.064
2	0.163
4	0.653

SAMPLE DATA

Date: <u>3/31/10</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(ft)</u>	Color / Odor / Comments
Time: <u>1645</u>								
Method: <u>low-flow</u>	<u>14.78</u>	<u>0.151*</u>	<u>3.21</u>	<u>4.17</u>	<u>17.7</u>	<u>8.23</u>	<u>4.70</u>	

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u> <u>(ft)</u>	Color / Odor / Comments
<u>1620</u>	<u>0.2</u>	<u>15.82</u>	<u>0.082</u>	<u>4.08</u>	<u>4.64</u>	<u>21.4</u>	<u>74.9</u>	<u>4.68</u>	
<u>1625</u>	<u>0.5</u>	<u>15.33</u>	<u>0.072*</u>	<u>3.55</u>	<u>4.42</u>	<u>-21.3</u>	<u>28.6</u>	<u>4.68</u>	
<u>1630</u>	<u>0.8</u>	<u>14.96</u>	<u>0.076*</u>	<u>3.52</u>	<u>4.44</u>	<u>1.1</u>	<u>16.4</u>	<u>4.69</u>	
<u>1635</u>	<u>1.1</u>	<u>15.09</u>	<u>0.071*</u>	<u>3.30</u>	<u>4.38</u>	<u>27.3</u>	<u>12.3</u>	<u>4.69</u>	
<u>1640</u>	<u>1.3</u>	<u>14.87</u>	<u>0.177*</u>	<u>3.31</u>	<u>4.15</u>	<u>-3.7</u>	<u>10.5</u>	<u>4.71</u>	
<u>1645</u>	<u>1.6</u>	<u>14.78</u>	<u>0.151*</u>	<u>3.21</u>	<u>4.17</u>	<u>17.7</u>	<u>8.23</u>	<u>4.70</u>	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>8380</u>	<u>None</u>	<u>1L amber</u>	<u>2</u>
<u>6850</u>	<u>None</u>	<u>250mL poly</u>	<u>1</u>
<u>6010B</u>	<u>HNO3</u>	<u>250mL poly</u>	<u>1</u>

Observations/Notes:

Started pump at 1617
set tubing at 10'
DTW - depth to water

* YSI showing sporadic conductivity readings

MS/MSD

Duplicate ID No.:

Signature(s):

Vendano Cruz



GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC
Location: MCB CAM LEST
Event: UXO-02 GLO SAMPLING
Date: 3/31/10
Weather: SUNNY 70'S

Project Number: _____
Well ID: MROZ-TW 28
Sample ID: MROZ-GW28-10A
Sampling Team: M. SMITH / RDU
S. FORNER / RDU

Total Depth: 14.55 FT.(BTOT)
Depth to water: (1) 5.45 FT.(BTOT)
Water Column: 9.1 FT.
(X) .041 GAL/FT.
Well Volume: .373 GAL.
Total Purge Vol.: _____ GAL.

Measuring Device: YSI / HANNA
Date and Time: 3/31/10 1600

Purge Device: GEO PUMP

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653

SAMPLE DATA

Date: <u>3/31/10</u>	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u>	Color / Odor / Comments
Time: <u>1200 - 1700</u>								
Method: <u>LOW-FLOW</u>	<u>12.60</u>	<u>.050</u>	<u>.76</u>	<u>4.29</u>	<u>258.4</u>	<u>16.0</u>	<u>5.65</u>	

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: <u>DTW</u>	Color / Odor / Comments
<u>1505</u>	<u>.2</u>	<u>14.07</u>	<u>.054</u>	<u>3.51</u>	<u>4.32</u>	<u>264.0</u>	<u>350</u>	<u>5.6</u>	
<u>1630</u>	<u>.4</u>	<u>13.4</u>	<u>.051</u>	<u>2.11</u>	<u>3.95</u>	<u>288.2</u>	<u>75.0</u>	<u>5.6</u>	
<u>1633</u>	<u>.6</u>	<u>12.86</u>	<u>.050</u>	<u>1.73</u>	<u>3.96</u>	<u>283.1</u>	<u>36.0</u>	<u>5.6</u>	
<u>1640</u>	<u>.8</u>	<u>13.04</u>	<u>.050</u>	<u>1.20</u>	<u>4.25</u>	<u>266.1</u>	<u>25.0</u>	<u>5.6</u>	
<u>1643</u>	<u>1</u>	<u>12.82</u>	<u>.050</u>	<u>1.08</u>	<u>4.65</u>	<u>255.4</u>	<u>19.0</u>	<u>5.6</u>	
<u>1648</u>	<u>1.2</u>	<u>12.72</u>	<u>.050</u>	<u>.99</u>	<u>4.52</u>	<u>258.2</u>	<u>19.0</u>	<u>5.65</u>	
<u>1655</u>	<u>1.4</u>	<u>12.67</u>	<u>.050</u>	<u>.88</u>	<u>4.28</u>	<u>259.5</u>	<u>20.0</u>	<u>5.65</u>	
<u>1700</u>	<u>1.6</u>	<u>12.60</u>	<u>.050</u>	<u>.76</u>	<u>4.29</u>	<u>258.4</u>	<u>16.0</u>	<u>5.65</u>	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
<u>EXP., PETN, NITROGLYCERIN</u>	<u>—</u>	<u>2 L</u>	<u>2</u>
<u>TAL METALS</u>	<u>HNO₃</u>	<u>250~1</u>	<u>1</u>
<u>PERCHLORATE</u>	<u>—</u>	<u>250~1</u>	<u>1</u>

Observations/Notes:

MS/MSD

Duplicate ID No.:

Signature(s): M. Smith



CH2MHILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTO-014
 Date: 3/30/10
 Weather: SUNNY, 60'S

Project Number: 378849.SI.FQ
 Well ID: M202-TW2A
 Sample ID: M202-GW24-10A
 Sampling Team: M. SMITH/ROU

Total Depth: 14.8 FT.(BTOC)
 Depth to water: (-) 6.11 FT.(BTOC)
 Water Column: 8.69 FT.
 (x) ~~3.56~~ GAL/FT. (0.41)
 Well Volume: 0.356 GAL.
 Total Purge Vol.: 0.9 GAL.

Measuring Device: YSI / HANNA
 Date and Time: 3/30/10 1600

Purge Device: GEO PUMP

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

FIELD PARAMETERS

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments VOL. PURGED
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		
1405	10.12	15.72	0.160	6.31	5.33	131.3	95.0	300	0.3
1610	12.50	15.60	0.197	4.35	5.30	40.7	100	300	0.6
1615	14.75	15.86	0.279	2.74	5.27	1.5	60.0	300	0.9

SAMPLE DATA

Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time:								
Method:								

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Total Metals	HNO3	250 mL poly	
Explosives + PETN	<4deg C	1 L amber	
Perchlorate	<4deg C	250 mL poly	
Nitroglycerin	<4deg C	1 L amber	
Dissolved Metals	HNO3	250 mL poly	

Observations/Notes:

Total Volume Purged: 0.9
 1616 WELL GOES DRY, WILL SET BAILER
 3/31/10 1235 COLLECTED SAMPLE

MS/MSD: YES NO Duplicate ID No.: _____

Signature(s):

[Signature]

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTO-014
 Date: 3/30/10
 Weather: SUNNY, 60'S

Project Number: 378849.SI.FQ
 Well ID: MRO2-TW-30
 Sample ID: MRO2-GW30-10A
 Sampling Team: M. SMITH / RPU

Total Depth: 14.8 FT.(BTOC)
 Depth to water: (-) 6.10 FT.(BTOC)
 Water Column: 8.10 FT.
(x) .041 GAL/FT.
 Well Volume: 0.3321 GAL.
 Total Purge Vol.: GAL.

Measuring Device: YSI / HANNA
 Date and Time: 3/30/10 1515

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

Purge Device: GEO PUMP

FIELD PARAMETERS

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments <small>DO NOT PURGE</small>
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		
1530	9.89	15.41	304	5.47	4.94	98.7	220	300	.5
1535	12.25	15.55	303	2.07	5.30	6.7	90.0	300	.8
1540	13.40	15.77	300	1.74	5.31	-31.7	140	300	1.25 1.2

SAMPLE DATA

Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: _____	Color / Odor / Comments
Time:								
Method:								

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Total Metals	HNO3	250 mL poly	
Explosives + PETN	<4deg C	1 L amber	
Perchlorate	<4deg C	250 mL poly	
Nitroglycerin	<4deg C	1 L amber	
Dissolved Metals	HNO3	250 mL poly	

Observations/Notes:

Total Volume Purged: 1.2

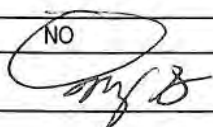
1545 WELL GOES DRY. WILL SET BAILER.
 3/31/10 1210 COLLECTED SAMPLE

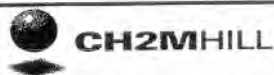
MS/MSD: YES

NO

Duplicate ID No.: _____

Signature(s):





GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
Location: Site 69/UXO-2
Event: Supplemental Investigation
Date: 3-8-10
Weather: Sunny, 65°F

Project Number: 374082.FI.FI.69

Well ID: IR69-MW05

Sample ID: IR69-GW05-10A, MR02-IR69-GW05-10A

Sampling Team: N. Munn

Total Depth: 21.0 FT.(BTOC)
Depth to water: (-) 9.72 FT.(BTOC)
Water Column: 11.28 FT.
(x) 6.163 GAL/FT.
Well Volume: 1.84 GAL. X3 = 5.52 gal
Total Purge Vol.: GAL.

Water Quality Equipment Info: YSI: 556 MPS

Purge Device: QED Bladder Pump

Pump Inlet Depth: 13.5 FT.(BTOC)

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653
6	1.469

page 1 of 2

SAMPLE DATA

Date: 3-8-10	Temp.	Cond.	DO	pH	ORP	Turbidity	Depth to water	Color / Odor / Comments
Time: 1520pm	°C	mS/cm	mg/L	SU	mV	NTU	(ft bgs)	
Method:								

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Stabilization Criteria		constant	±3%	±10%	±0.1	±10 mv	≤10		
1445	0.25	14.95	0.033	3.13	4.99	195.2	45.5	10.42	Clear, No odor
1450	1.25	14.19	0.032	2.02	4.72	219.1	45.0	12.21	" "
1455	2.00	14.82	0.034	2.01	4.68	235.8	25.9	13.69	" "
1500	3.25	14.89	0.034	2.13	4.69	239.8	18.1	13.50	Clear, No odor
1505	4.25	14.74	0.035	2.94	4.67	245.4	12.8	12.05	" "
1510	5.25	14.58	0.034	1.92	4.68	252.6	8.99	12.05	" "
1515	6.25	14.48	0.034	1.96	4.68	257.4	7.46	12.06	" "
1520	3.25	14.30	0.035	1.87	4.68	262.1	5.89	12.08	" "
1525	3.625	14.30	0.035	1.83	4.65	270.1	5.47	12.08	" "
1530	4.0	14.42	0.036	1.81	4.64	274.6	5.05	12.08	" "

Analysis	Preservative	Container requirements	No. of containers
TCL VOCs by EPA Method 8260B	HCl	40 ml glass vials	3 X2
Methane, Ethane, Ethene RSK-175	HCl	40 ml glass vials	2 X2
Total Organic Carbon by EPA Method 415.2	H ₂ SO ₄	40 ml glass vials	2 X2
Alkalinity, Chloride, Sulfate, Nitrate, Nitrite	None	250 ml poly bottle	1 X2
TAL Metals Method 6010B*	HNO ₃	500 ml poly bottle	1 X2
Sulfide	Zn-Acetate/6 N NaOH	500 ml poly bottle	1 X2
SVOC and PAH Method 8270C/ 8270C_SIM	None	1-L Amber	2 X2
OP Pesticides Method 8141A	None	1-L Amber	2 X2
OC Pesticides Method 3550B/8081A	None	1-L Amber	2 X2
PCBs Method 8082	None	1-L Amber	2 X2
Expl. Resid., PETN, Nitroglycerine, Method 8330***	None	1-L Amber	2 X2
Total Metals/Dissolved Metals Method 6010B***	HNO ₃	250 ml poly bottle	1 each X2
Perchlorate***	None	1-L Amber	1 X2

Observations/Notes:

Purge Start Time: 1440

Purge Rate:

Nitrate 0.0 mg/L

Nitrite 0.0 mg/L

Fe²⁺ 0.2 mg/L

*Microbial Samples for 11IW, 11DW, 13IW, 13DW, 26IW

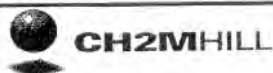
**TAL Metals Filtered in 500-mL poly, HNO₃ with 0.45 um filter for 09, 11, 12, 13,

***UXO-2 Wells: 5, 9, 11, 12, 13, 14, 15: For filtered: use 0.45 um filter, label with "-FF" to end of ID

MS/MSD N/A

Duplicate ID No: IR69-GW05D10A, MR02-IR69-GW05D-10A

Signature(s):



GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
Location: Site 69/UXO-2
Event: Supplemental Investigation
Date: 3-8-10
Weather: Sunny

Project Number: 374082.FI.FI.69
Well ID: IR69-mw05
Sample ID: IR69-GW05-10A, MR02-IR69-GW05-10A
Sampling Team: N. Monroe

Total Depth: FT.(BTOC)
Depth to water: (-) FT.(BTOC)
Water Column: (x) FT.
Well Volume: GAL.
Total Purge Vol.: GAL.

Water Quality Equipment Info: p2

Purge Device: p2

Pump Inlet Depth: FT.(BTOC)

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653
6	1.469

page 2 of 2

SAMPLE DATA

Date: 3-8-10	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Time: 1600								
Method: Low Flow	14.45	0.040	1.63	4.57	285.0	4.16	12.09	Clear, No odor

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Stabilization Criteria		constant	±3%	±10%	±0.1	±10 mV	<10		
1535	4.375	14.53	0.037	1.79	4.64	279.3	4.70	12.09	Clear, No odor
1540	4.75	14.51	0.038	1.75	4.62	280.1	4.63	12.09	" "
1545	5.125	14.49	0.038	1.71	4.60	281.2	4.59	12.09	" "
1550	5.5	14.47	0.039	1.67	4.58	283.5	4.51	12.09	" "
0930	0.25	13.68	0.048	5.74	5.37	230.8	11.0	10.10	" "
0935	0.5	13.52	0.044	5.33	5.08	271.6	12.0	10.12	" "
0940	0.75	13.54	0.043	4.92	5.04	280.6	9.90	10.12	" "
0945	1.0	13.55	0.043	4.66	4.99	293.1	9.10	10.12	" "
0950	1.25	13.56	0.043	4.60	4.99	295.0	8.30	10.11	" "
0955	1.5	13.60	0.043	4.48	4.98	301.0	8.12	10.11	" "

Analysis	Preservative	Container requirements	No. of containers
TCL VOCs by EPA Method 8260B	HCl	40 ml glass vials	3 x 2
Methane, Ethane, Ethene RSK-175	HCl	40 ml glass vials	2 x 2
Total Organic Carbon by EPA Method 415.2	H ₂ SO ₄	40 ml glass vials	2 x 2
Alkalinity, Chloride, Sulfate, Nitrate, Nitrite	None	250 ml poly bottle	1 x 2
TAL Metals Method 6010B*	HNO ₃	500 ml poly bottle	1 x 2
Sulfide	Zn-Acetate/6 N NaOH	500 ml poly bottle	1 x 2
SVOC and PAH Method 8270C/ 8270C_SIM	None	1-L Amber	2 x 2
OP Pesticides Method 8141A	None	1-L Amber	2 x 2
OC Pesticides Method 3550B/8081A	None	1-L Amber	2 x 2
PCBs Method 8082	None	1-L Amber	2 x 2
Expl. Resid., PETN, Nitroglycerine, Method 8330***	None	1-L Amber	2 x 2
Total Metals/Dissolved Metals Method 6010B***	HNO ₃	250 ml poly bottle	1 each x 2
Perchlorate***	None	1-L Amber	1 x 2

Observations/Notes:

Purge Start Time: 1440

Purge Rate:

Nitrate _____ mg/L

Nitrite _____ mg/L

Fe²⁺ _____ mg/L

Incomplete Sample @ 1745, will finish in AM.

0930 (3-9-10) - Completing Sample

*Microbial Samples for 11IW, 11DW, 13IW, 13DW, 26IW

**TAL Metals Filtered in 500-mL poly, HNO₃ with 0.45 um filter for 09, 11, 12, 13,

***UXO-2 Wells: 5, 9, 11, 12, 13, 14, 15: For filtered: use 0.45 um filter, label with *-FF to end of ID

MS/MSD N/A

Duplicate ID No.: IR69-GW05D 10A, MR02-IR69-GW05D-10A e1605

Signature(s): [Signature]



CH2MHILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: Site 69/UXO-2
 Event: Supplemental Investigation
 Date: 3-1-10
 Weather: Sunny, 45°F

Project Number: 374082.FI.FI.69

Well ID: IR69-MW09

Sample ID: IR69-GW09-10A, MR02-IR69-GW09-10A

Sampling Team: N. M. Moore

Total Depth: 21.0 FT.(BTOC)
 Depth to water: (-) 7.32 FT.(BTOC)
 Water Column: 13.68 FT.
 (x) 0.163 GAL/FT.
 Well Volume: 2.23 GAL.
 Total Purge Vol.: GAL.

Water Quality Equipment Info: YSI 556 MPS

S/N 04963

Purge Device: QED Bladder Pump

Pump Inlet Depth: 15 FT.(BTOC)

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653
6	1.469

page 1 of 2

SAMPLE DATA

Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Time:								
Method:								

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Stabilization Criteria		constant	± 3%	± 10%	± 0.1	± 10 mv	<10		
0937	0.0	14.75					100	7.75	Cloudy, No odor
0940	0.5	14.90	0.108	3.48	5.19	211.3	140	7.75	" "
0943	0.75	15.08	0.107	3.76	5.23	221.8	102	7.70	" "
0946	1.0	15.21	0.107	3.78	5.24	226.9	95	7.60	" "
0949	1.25	15.28	0.107	3.88	5.23	239.5	87	7.50	" "
0952	1.5	15.28	0.107	3.84	5.30	233.2	86	7.51	" "
0955	1.75	15.31	0.107	3.94	5.31	234.6	73	7.52	" "
0958	2.0	15.31	0.106	3.80	5.30	237.1	62	7.	" "
1001	2.25	15.32	0.106	3.68	5.30	240.5	51	7.	" "
1004	2.50	15.33	0.106	3.56	5.29	242.4	45.1	7.67	" "

Analysis	Preservative	Container requirements	No. of containers
TCL VOCs by EPA Method 8260B	HCl	40 ml glass vials	3
Methane, Ethane, Ethene RSK-175	HCl	40 ml glass vials	2
Total Organic Carbon by EPA Method 415.2	H ₂ SO ₄	40 ml glass vials	2
Alkalinity, Chloride, Sulfate, Nitrate, Nitrite	None	250 ml poly bottle	1
TAL Metals Method 6010B*	HNO ₃	500 ml poly bottle	1
Sulfide	Zn-Acetate/6 N NaOH	500 ml poly bottle	1
SVOC and PAH Method 8270C/ 8270C_SIM	None	1-L Amber	2
OP Pesticides Method 8141A	None	1-L Amber	2
OC Pesticides Method 3550B/8081A	None	1-L Amber	2
PCBs Method 8082	None	1-L Amber	2
Expl. Resid., PETN, Nitroglycerine, Method 8330***	None	1-L Amber	2
Total Metals/Dissolved Metals Method 6010B***	HNO ₃	250 ml poly bottle	1 each
Perchlorate***	None	1-L Amber	1

Observations/Notes:

Purge Start Time: 0935

Purge Rate:

Nitrate 0 mg/L

Nitrite 0 mg/L

Fe²⁺ 0 mg/L

*Microbial Samples for 11IW, 11DW, 13IW, 13DW, 26IW

**TAL Metals Filtered in 500-mL poly, HNO₃ with 0.45 um filter for 09, 11, 12, 13,

***UXO-2 Wells: 5, 9, 11, 12, 13, 14, 15: For filtered: use 0.45 um filter, label with "-FF" to end of ID

MS/MSD MR02-IR69-GW09-10A-MS, SD Duplicate ID No.: MR02-IR69-GW09-10A

Signature(s): [Signature]



CH2MHILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: Site 69/UXO-2
 Event: Supplemental Investigation
 Date: 3-1-10
 Weather:

Project Number: 374082.FI.FI.69

Well ID: IR69-MW09

Sample ID: IR69-GW09-10A, MR02-IR69-GW09-10A

Sampling Team: N. Monte

Total Depth: FT.(BTOC)
 Depth to water: (-) FT.(BTOC)
 Water Column: FT.
 (X) GAL/FT.
 Well Volume: GAL.
 Total Purge Vol.: GAL.

Water Quality Equipment Info: p1 3/27/10

Purge Device: QED Bladder Pump

Pump Inlet Depth: 15 FT.(BTOC)

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653
6	1.469

page 2 of 2

SAMPLE DATA

Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
3-1-10								
Time: 1035								
Method: Low Flow	15.37	0.106	3.29	5.26	260.9	28.3	7.62	Clear No odor

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Stabilization Criteria		constant	± 3%	± 10%	± 0.1	± 10 mv	<10		
10:07	3.0	15.32	0.106	3.51	5.28	246.5	41.0	7.67	Cloudy, No odor
10:10	3.25	15.44	0.106	3.52	5.29	248.2	36.6	7.65	" "
10:13	3.5	15.44	0.106	3.49	5.29	250.1	33.4	7.64	" "
10:16	3.75	15.45	0.106	3.37	5.28	251.2	30.1	7.63	" "
10:19	4.0	15.45	0.106	3.35	5.28	252.1	28.9	7.63	Clear, No odor
10:22	4.25	15.36	0.106	3.53	5.29	253.9	30.7	7.65	" "
10:25	4.5	15.39	0.106	3.53	5.30	254.9	30.1	7.67	" "
10:28	4.75	15.42	0.106	3.45	5.27	257.4	29.2	7.65	" "
10:31	5.0	15.42	0.106	3.35	5.27	258.6	28.6	7.63	" "
10:34	5.25	15.39	0.106	3.31	5.26	260.0	28.3	7.63	" "

Analysis	Preservative	Container requirements	No. of containers
TCL VOCs by EPA Method 8260B	HCl	40 ml glass vials	3
Methane, Ethane, Ethene RSK-175	HCl	40 ml glass vials	2
Total Organic Carbon by EPA Method 415.2	H ₂ SO ₄	40 ml glass vials	2
Alkalinity, Chloride, Sulfate, Nitrate, Nitrite	None	250 ml poly bottle	1
TAL Metals Method 6010B*	HNO ₃	500 ml poly bottle	1
Sulfide	Zn-Acetate/6 N NaOH	500 ml poly bottle	1
SVOC and PAH Method 8270C/ 8270C_SIM	None	1-L Amber	2
OP Pesticides Method 8141A	None	1-L Amber	2
OC Pesticides Method 3550B/8081A	None	1-L Amber	2
PCBs Method 8082	None	1-L Amber	2
Expl. Resid., PETN, Nitroglycerine, Method 8330***	None	1-L Amber	2
Total Metals/Dissolved Metals Method 6010B***	HNO ₃	250 ml poly bottle	1 each
Perchlorate***	None	1-L Amber	1

Observations/Notes:

Purge Start Time: 0935

Purge Rate:

Nitrate _____ mg/L

Nitrite _____ mg/L

Fe²⁺ _____ mg/L

*Microbial Samples for 11IW, 11DW, 13IW, 13DW, 26IW

**TAL Metals Filtered in 500-mL poly, HNO₃ with 0.45 um filter for 09, 11, 12, 13,

***UXO-2 Wells: 5, 9, 11, 12, 13, 14, 15: For filtered: use 0.45 um filter, label with "-FF" to end of ID

MS/MSD MR02-IR69-GW09-10A-M5, SD Duplicate ID No.:

Signature(s):



CH2MHILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: Site 69/UXO-2
 Event: Supplemental Investigation
 Date: 3/1/10
 Weather: CLEAR SUNNY / ~45F

Project Number: 374082.FI.FI.69
 Well ID: IR69-MW11
 Sample ID: IR69-GW11-10A/MRO2-IR69-GW-10A
 Sampling Team: R. FIELDS

Total Depth: 19.0 FT.(BTOC) HISTORICAL
 Depth to water: (-) 5.42 FT.(BTOC)
 Water Column: 13.58 FT.
 (x) 0.163 GAL/FT.
 Well Volume: ~2.2 GAL.
 Total Purge Vol.: GAL.

Water Quality Equipment Info: YSI 566

Purge Device: QED BLADDER PUMP

Pump Inlet Depth: ~14 FT.(BTOC)

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653
6	1.469

page 1 of 1

SAMPLE DATA

Date:	Temp.	Cond.	DO	pH	ORP	Turbidity	Depth to water	Color / Odor / Comments
3/1/10	°C	mS/cm	mg/L	SU	mV	NTU	(ft bgs)	
Time: 1055								
Method: LOW-FLOW	13.80	0.44	0.94	4.21	354.1	4.72	5.65	CLEAR

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Stabilization Criteria		constant	± 3%	± 10%	± 0.1	± 10 mv	<10		
0948	0.10	13.45	0.061	0.323	4.14	331.6	6.50	5.65	~300 mg/min
1000	=1.0	13.43	0.062	2.48	4.18	334.2	6.30	5.65	
1005	=1.4	13.41	0.062	1.69	4.18	341.7	5.70	5.65	
1010	=1.8	13.52	0.049	1.36	4.19	347.9	5.10	5.65	
1015	=2.2	13.67	0.047	1.22	4.21	348.8	4.70	5.65	
1020	=2.6	13.71	0.043	1.22	4.15	352.2	4.90	5.65	
1025	=3.0	13.79	0.044	0.95	4.20	353.0	4.75	5.65	
1030	=3.4	13.80	0.044	0.95	4.21	353.1	4.72	5.65	

Analysis	Preservative	Container requirements	No. of containers
TCL VOCs by EPA Method 8260B	HCl	40 ml glass vials	3
Methane, Ethane, Ethene RSK-175	HCl	40 ml glass vials	2
Total Organic Carbon by EPA Method 415.2	H ₂ SO ₄	40 ml glass vials	2
Alkalinity, Chloride, Sulfate, Nitrate, Nitrite	None	250 ml poly bottle	1
TAL Metals Method 6010B*	HNO ₃	500 ml poly bottle	1
Sulfide	Zn-Acetate/6 N NaOH	500 ml poly bottle	1
SVOC and PAH Method 8270C/ 8270C_SIM	None	1-L Amber	2
OP Pesticides Method 8141A	None	1-L Amber	2
OC Pesticides Method 3550B/8081A	None	1-L Amber	2
PCBs Method 8082	None	1-L Amber	2
Expl. Resid., PETN, Nitroglycerine, Method 8330***	None	1-L Amber	2
Total Metals/Dissolved Metals Method 6010B***	HNO ₃	250 ml poly bottle	1 each
Perchlorate***	None	1-L Amber	1

Observations/Notes:

Purge Start Time: 0948

Purge Rate:

Nitrate 0 mg/L

Nitrite 0 mg/L

Fe²⁺ 0.25 mg/L

*Microbial Samples for 11IW, 11DW, 13IW, 13DW, 26IW

**TAL Metals Filtered in 500-mL poly, HNO₃ with 0.45 um filter for 09, 11, 12, 13,

***UXO-2 Wells: 5, 9, 11, 12, 13, 14, 15: For filtered: use 0.45 um filter, label with "-FF" to end of ID

MS/MSD

Duplicate ID No.:

Signature(s):

[Signature] 3/1/10



GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: Site 69/UXO-2
 Event: Supplemental Investigation
 Date: 2/27/10
 Weather: PARTLY CLOUDY ~ 47°F

Project Number: 374082.FI.FI.69

Well ID: IR69 - GW12

Sample ID: MRO2-IR69-GW12-10A/IR69-GW12-10A

Sampling Team: R. FIELDS / N. MURPHY

Total Depth: 12.5 FT.(BTOC) HISTORICAL

Depth to water: (-) 3.50 FT.(BTOC)

Water Column: 9.0 FT.

(x) 0.163 GAL/FT.

Well Volume: = 1.5 GAL.

Total Purge Vol.: = 1.5 GAL.

Purge Device: QED BLADDER PUMP

Pump Inlet Depth: = 7 FT.(BTOC)

Water Quality Equipment Info: YSI 556 MPS

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653
6	1.469

page 1 of 1

SAMPLE DATA

Date:	Time:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
2/27/10	1425								
Method: LOW-FLOW		11.61	0.051	0.63	4.95	22.0	5.51	4.42	CLEAR @ 1420

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Stabilization Criteria		constant	± 3%	± 10%	± 0.1	± 10 mv	<10		
1220	0	12.35	0.076	3.72	4.83	201.1	70.2	3.95	FLOW RATE = 75 ml/min
1225	= 0.10	12.15	0.085	2.32	4.84	183.1	51.5	3.95	
1235	= 0.60	11.98	0.062	1.44	4.87	155.1	31.4	4.35	FLOW RATE = 300 ml/min
1240	= 0.75	11.78	0.051	1.56	4.89	87.9	23.0	4.43	
1245	= 1	11.71	0.056	1.18	4.95	50.7	14.4	4.44	
1256	= 1.5	11.70	0.059	0.85	4.98	30.3	7.97	4.47	FLOW RATE = 170 ml/min
1308	= 2.0	11.63	0.063	0.64	5.10	24.0	5.59	4.47	
1328	= 2.75	11.63	0.063	0.62	4.98	25.9	5.53	4.45	
1349	= 3.5	11.61	0.050	0.65	4.95	26.0	5.53	4.43	
1426	= 4.5	11.61	0.051	0.63	4.95	22.0	5.51	4.42	

Analysis	Preservative	Container requirements	No. of containers
TCL VOCs by EPA Method 8260B	HCl	40 ml glass vials	3 ✓
Methane, Ethane, Ethene RSK-175	HCl ?	40 ml glass vials	2 ✓
Total Organic Carbon by EPA Method 415.2	H ₂ SO ₄	40 ml glass vials	2 ✓
Alkalinity, Chloride, Sulfate, Nitrate, Nitrite	None	250 ml poly bottle	1 ✓
TAL Metals Method 6010B*	HNO ₃	500 ml poly bottle	1 ✓
Sulfide	Zn-Acetate/6 N NaOH	500 ml poly bottle	1 ✓
SVOC and PAH Method 8270C/ 8270C_SIM	None	1-L Amber	2 ✓
OP Pesticides Method 8141A	None	1-L Amber	2 ✓
OC Pesticides Method 3550B/8081A	None	1-L Amber	2 ✓
PCBs Method 8082	None	1-L Amber	2 ✓
Expl. Resid., PETN, Nitroglycerine, Method 8330***	None	1-L Amber	2 ✓
Total Metals/Dissolved Metals Method 6010B***	HNO ₃	250 ml poly bottle	1 each ✓
Perchlorate***	None	1-L Amber	1 ✓

Observations/Notes:

Purge Start Time: 1215 / END 1530

Purge Rate: ~ 0.038 GPM

Nitrate 0.0 mg/L

Nitrite 0.0 mg/L

Fe²⁺ 2.1 mg/L

NOTE @ 1310 COMPRESSOR SHUT OFF - DUE TO BATTERY ISSUES
 RUNNING COMPRESSOR OFF OF THE MULE. R. FIELDS

*Microbial Samples for 11IW, 11DW, 13IW, 13DW, 26IW

**TAL Metals Filtered in 500-mL poly, HNO₃ with 0.45 um filter for 09, 11, 12, 13,

***UXO-2 Wells: 5, 9, 11, 12, 13, 14, 15: For filtered: use 0.45 um filter, label with "-FF" to end of ID

MS/MSD

Duplicate ID No.:

Signature(s):

SAMPLE COLLECTED @ 1425



CH2MHILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: Site 69/UXO-2
 Event: Supplemental Investigation
 Date: 3-1-10
 Weather: Sunny, 53°F

Project Number: 374082.FI.FI.69

Well ID: TR69-MW13
 Sample ID: TR69-MW13-10A, MRD2-TR69-MW13-10A
 Sampling Team: N. Monroe
 R. Fields

Total Depth: 13.0 FT.(BTOC)
 Depth to water: (-) 4.18 FT.(BTOC)
 Water Column: 8.82 FT.
 (x) 0.163 GAL/FT.
 Well Volume: 1.44 GAL.
 Total Purge Vol.: 2.5 GAL.

Water Quality Equipment Info: YSI 556 MPS
 SN: 04963

Purge Device: QED Bladder Pump

Pump Inlet Depth: 8 FT.(BTOC)

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653
6	1.469

page 1 of 1

SAMPLE DATA

Date: 3-1-10	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Time: 1445								
Method: Low Flow	11.09	0.045	0.50	4.69	65.9	9.0	4.62	Clear, No odor

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Stabilization Criteria		constant	±3%	±10%	±0.1	±10 mv	<10		
1418	0.0	12.62	0.046	1.90	4.70	258.3	72.8	4.69	Cloudy, rust color, No odor
1421	0.5	11.97	0.044	1.27	4.61	279.0	50.2	4.62	" "
1424	0.75	11.53	0.044	0.98	4.61	160.3	28.8	4.62	Clear, No odor
1427	1.0	11.34	0.044	0.84	4.63	124.1	21.2	4.62	" "
1430	1.25	11.15	0.044	0.69	4.64	91.3	15.1	4.62	" "
1433	1.5	11.21	0.044	0.62	4.65	82.2	14.2	4.62	" "
1436	1.75	11.17	0.045	0.57	4.67	75.6	12.7	4.62	" "
1439	2.0	11.14	0.045	0.54	4.68	72.2	11.4	4.62	" "
1442	2.25	11.10	0.045	0.51	4.69	67.8	9.99	4.62	" "

Analysis	Preservative	Container requirements	No. of containers
TCL VOCs by EPA Method 8260B	HCl	40 ml glass vials	3
Methane, Ethane, Ethene RSK-175	HCl	40 ml glass vials	2
Total Organic Carbon by EPA Method 415.2	H ₂ SO ₄	40 ml glass vials	2
Alkalinity, Chloride, Sulfate, Nitrate, Nitrite	None	250 ml poly bottle	1
TAL Metals Method 6010B*	HNO ₃	500 ml poly bottle	1
Sulfide	Zn-Acetate/6 N NaOH	500 ml poly bottle	1
SVOC and PAH Method 8270C/ 8270C_SIM	None	1-L Amber	2
OP Pesticides Method 8141A	None	1-L Amber	2
OC Pesticides Method 3550B/8081A	None	1-L Amber	2
PCBs Method 8082	None	1-L Amber	2
Expl. Resid., PETN, Nitroglycerine, Method 8330***	None	1-L Amber	2
Total Metals/Dissolved Metals Method 6010B***	HNO ₃	250 ml poly bottle	1 each
Perchlorate***	None	1-L Amber	1

Observations/Notes:

Purge Start Time: 1415

Purge Rate: 400 ml/min

Nitrate 0.0 mg/L

Nitrite 0.0 mg/L

Fe²⁺ 1.4 mg/L

*Microbial Samples for 11IW, 11DW, 13IW, 13DW, 26IW

**TAL Metals Filtered in 500-mL poly, HNO₃ with 0.45 um filter for 09, 11, 12, 13,

***UXO-2 Wells: 5, 9, 11, 12, 13, 14, 15: For filtered: use 0.45 um filter, label with "-FF" to end of ID

MS/MSD

N/A

Duplicate ID No.:

N/A

Signature(s):

[Signature]



GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
Location: Site 69/UXO-2
Event: Supplemental Investigation
Date: 2-28-10
Weather: Sunny, 45°F

Project Number: 374082.FI.FI.69

Well ID: TR69-MW14
Sample ID: TR69-GW14-70A, MRO2-TR69-GW14-70A
Sampling Team: N. Monne, R. Fields
J. High

Total Depth: 13.0 FT.(BTOC)
Depth to water: 11.05 FT.(BTOC)
Water Column: 2.95 FT.
(X) 0.163 GAL/FT. Initial PID = 0.0ppm
Well Volume: 1.30 GAL.
Total Purge Vol.: 2.25 GAL.

Water Quality Equipment Info: YSI 556 S/N:

Purge Device: QED Bladder Pump

Pump Inlet Depth: 8 FT.(BTOC)

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
(2)	0.163
4	0.653
6	1.469

page 1 of 1

SAMPLE DATA

Date:	Time:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
2-28-10	11:30								
Method: Low Flow		9.75	0.003	1.93	4.95	248.1	8	5.16	Clear, No odor

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Stabilization Criteria		constant	± 3%	± 10%	± 0.1	± 10 mv	<10		
1055	~0.0	10.20	0.060	8.88	5.21	201.1	40	5.15	Clear, No odor
1058	~0.5	10.05	0.061	8.28	5.09	208.4	55	5.15	" "
1101	~0.875	9.90	0.063	3.73	5.03	224.4	40	5.17	" "
1104	~1.125	9.84	0.063	2.70	5.00	232.7	42	5.16	" "
1107	~1.25	9.82	0.063	2.27	4.99	235.4	45	5.16	" "
1110	~1.50	9.80	0.063	2.00	4.97	242.6	12	5.16	" "
1113	~1.75	9.77	0.063	2.00	4.98	244.8	10	5.16	" "
1116	~2.25	9.76	0.063	1.95	4.95	247.7	8	5.17	" "

Analysis	Preservative	Container requirements	No. of containers
TCL VOCs by EPA Method 8260B	HCl	40 ml glass vials	3
Methane, Ethane, Ethene RSK-175	HCl	40 ml glass vials	2
Total Organic Carbon by EPA Method 415.2	H ₂ SO ₄	40 ml glass vials	2
Alkalinity, Chloride, Sulfate, Nitrate, Nitrite	None	250 ml poly bottle	1
TAL Metals Method 6010B*	HNO ₃	500 ml poly bottle	1
Sulfide	Zn-Acetate/6 N NaOH	500 ml poly bottle	1
SVOC and PAH Method 8270C/ 8270C_SIM	None	1-L Amber	2
OP Pesticides Method 8141A	None	1-L Amber	2
OC Pesticides Method 3550B/8081A	None	1-L Amber	2
PCBs Method 8082	None	1-L Amber	2
Expl. Resid., PETN, Nitroglycerine, Method 8330***	None	1-L Amber	2
Total Metals/Dissolved Metals Method 6010B***	HNO ₃	250 ml poly bottle	1 each
Perchlorate***	None	1-L Amber	1

Observations/Notes:

Purge Start Time: 10:4550

Purge Rate:

Nitrate 0.0 mg/L

Nitrite 0.091 mg/L

Fe²⁺ 0.2 mg/L

*Microbial Samples for 11IW, 11DW, 13IW, 13DW, 26IW

**TAL Metals Filtered in 500-mL poly, HNO₃ with 0.45 um filter for 09, 11, 12, 13,

***UXO-2 Wells: 5, 9, 11, 12, 13, 14, 15: For filtered: use 0.45 um filter, label with "FF" to end of ID

MS/MSD

N/A

Duplicate ID No.:

N/A

Signature(s):

Nite Monne



CH2MHILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: Site 69/UXO-2
 Event: Supplemental Investigation
 Date: 3-7-10
 Weather: Sunny, 50°F

Project Number: 374082.FI.FI.69

Well ID: IR69-MW15

Sample ID: IR69-GW15-10A

Sampling Team: N. Monroe

R. Fields

Total Depth: 13.0 FT.(BTOC)
 Depth to water: (-) 2.13 FT.(BTOC) P.D.
 Water Column: 10.87 FT.
 (x) 0.163 GAL/FT.
 Well Volume: 1.78 GAL. $\times 3 = 5.32 \text{ gal}$
 Total Purge Vol.: 4.5 GAL.

Water Quality Equipment Info: YSI: 556 MPS

SN: 04963

Purge Device: QED Bladder Pump

Pump Inlet Depth: 8 FT.(BTOC)

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
②	0.163
4	0.653
6	1.469

page 1 of 2

SAMPLE DATA

Date: 3-7-10	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Time: 11:40								
Method: Low Flow								

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Stabilization Criteria		constant	±3%	±10%	±0.1	±10 mv	<10		
1040	0.25	11.17	0.323	1.22	5.31	54.0	310	2.32	rust color, cloudy, no odor
1043	0.5	11.05	0.326	1.12	5.37	43.0	200	2.32	" " "
1044	0.75	11.17	0.333	0.83	5.43	33.3	140	2.32	" " "
1049	1.0	11.16	0.335	0.80	5.38	33.2	140	2.32	" " "
1052	1.25	11.20	0.338	0.75	5.37	30.1	125	2.32	" " "
1055	1.5	11.23	0.341	0.69	5.37	27.9	110	2.33	" " "
1058	1.75	11.08	0.344	0.60	5.33	26.3	95.0	2.33	" " "
1101	2.0	10.91	0.354	0.52	5.38	23.2	65.0	2.33	" " "
1104	2.25	10.87	0.363	0.50	5.34	22.6	59.1	2.33	rust tint, clear, no odor
1107	2.5	10.91	0.372	0.47	5.34	21.4	53.0	2.33	

Analysis	Preservative	Container requirements	No. of containers
TCL VOCs by EPA Method 8260B	HCl	40 ml glass vials	3
Methane, Ethane, Ethene RSK-175	HCl	40 ml glass vials	2
Total Organic Carbon by EPA Method 415.2	H ₂ SO ₄	40 ml glass vials	2
Alkalinity, Chloride, Sulfate, Nitrate, Nitrite	None	250 ml poly bottle	1
TAL Metals Method 6010B*	HNO ₃	500 ml poly bottle	1
Sulfide	Zn-Acetate/6 N NaOH	500 ml poly bottle	1
SVOC and PAH Method 8270C/ 8270C_SIM	None	1-L Amber	2
OP Pesticides Method 8141A	None	1-L Amber	2
OC Pesticides Method 3550B/8081A	None	1-L Amber	2
PCBs Method 8082	None	1-L Amber	2
Expl. Resid., PETN, Nitroglycerine, Method 8330***	None	1-L Amber	2
Total Metals/Dissolved Metals Method 6010B***	HNO ₃	250 ml poly bottle	1 each
Perchlorate***	None	1-L Amber	1

Observations/Notes:

Purge Start Time: 1035

Purge Rate: 300 ml/min

Nitrate 0.0 mg/L

Nitrite 0.198 mg/L 0.06 x 3.3

Fe²⁺ 4.4 mg/L

*Microbial Samples for 11IW, 11DW, 13IW, 13DW, 26IW

**TAL Metals Filtered in 500-mL poly, HNO₃ with 0.45 um filter for 09, 11, 12, 13,

***UXO-2 Wells: 5, 9, 11, 12, 13, 14, 15: For filtered: use 0.45 um filter, label with "-FF" to end of ID

MS/MSD

Duplicate ID No.: N/A

Signature(s):



CH2MHILL

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: Site 69/UXO-2
 Event: Supplemental Investigation
 Date: 3-7-10
 Weather: Sunny, 58°F

Project Number: 374082.FI.F1.69

Well ID: IR69-MW15

Sample ID: IR69-GW15-10A

Sampling Team: N. Monse

R. Felder

Total Depth: FT.(BTOC)
 Depth to water: (-) FT.(BTOC)
 Water Column: (X) FT.
 Well Volume: GAL.
 Total Purge Vol.: 4.5 GAL.

Water Quality Equipment Info: YSE:556 mps

Purge Device: QED Bladder Pump

Pump Inlet Depth: 8 FT.(BTOC)

Well Dia. (inches)	Volume (gallons/foot)
1	0.041
1.25	0.064
2	0.163
4	0.653
6	1.469

page 2 of 2

SAMPLE DATA

Date: 3-7-10	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Time: 1140								
Method: Lowflow								

FIELD PARAMETERS

Time	Purge Vol. (gals)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Depth to water (ft bgs)	Color / Odor / Comments
Stabilization Criteria		constant	±3%	±10%	±0.1	±10 mv	<10		
1110	2.75	10.95	0.381	0.44	5.33	20.5	46.5	2.33	Rust Tint
1113	3.0	10.00	0.390	0.41	5.33	19.4	40.0	2.33	Clear, No odor
1114	3.25	11.15	0.401	0.39	5.33	18.1	35.0	2.33	" "
1119	3.5	11.29	0.413	0.35	5.32	17.0	31.0	2.33	" "
1122	3.75	11.34	0.421	0.33	5.33	16.9	25.0	2.33	" "
1125	4.00	11.29	0.427	0.31	5.30	16.0	23.0	2.33	" "
1128	4.25	11.05	0.433	0.29	5.34	15.0	22.0	2.33	" "
1131	4.5	10.89	0.438	0.28	5.33	13.5	23.0	2.33	" "

Analysis	Preservative	Container requirements	No. of containers
TCL VOCs by EPA Method 8260B	HCl	40 ml glass vials	3
Methane, Ethane, Ethene RSK-175	HCl	40 ml glass vials	2
Total Organic Carbon by EPA Method 415.2	H ₂ SO ₄	40 ml glass vials	2
Alkalinity, Chloride, Sulfate, Nitrate, Nitrite	None	250 ml poly bottle	1
TAL Metals Method 6010B*	HNO ₃	500 ml poly bottle	1
Sulfide	Zn-Acetate/6 N NaOH	500 ml poly bottle	1
SVOC and PAH Method 8270C/ 8270C_SIM	None	1-L Amber	2
OP Pesticides Method 8141A	None	1-L Amber	2
OC Pesticides Method 3550B/8081A	None	1-L Amber	2
PCBs Method 8082	None	1-L Amber	2
Expl. Resid., PETN, Nitroglycerine, Method 8330***	None	1-L Amber	20 x 11m
Total Metals/Dissolved Metals Method 6010B***	HNO ₃	250 ml poly bottle	1 each
Perchlorate***	None	1-L Amber	1

Observations/Notes:

Purge Start Time: P1

Purge Rate: 300 mL/min

Nitrate _____ mg/L

Nitrite _____ mg/L

Fe²⁺ _____ mg/L

*Microbial Samples for 11IW, 11DW, 13IW, 13DW, 26IW

**TAL Metals Filtered in 500-mL poly, HNO₃ with 0.45 um filter for 09, 11, 12, 13,

***UXO-2 Wells: 5, 9, 11, 12, 13, 14, 15: For filtered: use 0.45 um filter, label with "-FF" to end of ID

MS/MSD

Duplicate ID No.: N/A

Signature(s):

Appendix F

Raw Analytical Data

TABLE F-1
UXO-02 Surface Soil Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background SS 2X Mean	NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	MR02-SS115	MR02-SS116	MR02-SS117	MR02-SS118	MR02-SS119	MR02-SS120	MR02-SS121		MR02-SS122	MR02-SS123	MR02-SS124	MR02-SS125	MR02-SS126
Sample ID					MR02-SS115-10A	MR02-SS116-10A	MR02-SS117-10A	MR02-SS118-10A	MR02-SS119-10A	MR02-SS120-10A	MR02-SS121-10A	MR02-SS121D-10A	MR02-SS122-10A	MR02-SS123-10A	MR02-SS124-10A	MR02-SS125-10A	MR02-SS126-10A
Sample Date					02/04/10	02/04/10	02/04/10	02/04/10	02/02/10	02/02/10	02/02/10	02/02/10	02/02/10	02/02/10	02/02/10	02/04/10	02/02/10
Chemical Name																	
Semivolatile Organic Compounds (µg/kg)																	
No Detections																	
Explosives (µg/kg)																	
No Detections																	
Total Metals (mg/kg)																	
Aluminum	5,487	--	99,000	7,700	3,160 J	3,380 J	8,440 J	2,750 J	650 J	901	757	692	2,320 J	4,570 J	2,010 J	4,470 J	456 J
Antimony	0.447	--	41	3.1	2.2 U	2.4 U	0.14 J	2 U	2 UJ	1.8 UJ	2.1 UJ	3.2 J	2.1 UJ	2.1 UJ	1.7 UJ	2.7 U	2 UJ
Arsenic	0.626	5.8	1.6	0.39	0.8	0.35 J	0.57 J	0.16 J	0.2 J	0.27 J	0.42 J	0.31 J	0.28 J	0.55	0.33 J	0.56 J	0.3 J
Barium	14.5	580	19,000	1,500	45 U	47 U	48 U	39 U	5.5 J	2.8 J	5.8 J	5.2 J	12.2 J	33.9 J	10 J	54 U	15.7 J
Beryllium	0.103	--	200	16	0.06 J	0.06 J	0.16 J	0.1 J	0.99 U	0.92 U	1 U	0.82 U	1 U	1.1 U	0.86 U	0.03 J	1 U
Cadmium	0.033	3	80	7	0.79 U	0.82 U	0.84 U	0.68 U	0.69 U	0.65 U	0.72 U	0.58 U	0.73 U	0.74 U	0.6 U	0.94 U	0.7 U
Calcium	6,360	--	--	--	1,100 UJ	1,200 UJ	1,200 UJ	980 UJ	990 U	920 U	1,000 U	820 U	1,000 UJ	2,330	860 UJ	1,300 UJ	1,000 U
Chromium	6.05	3.8	5.6	0.29	2.6	2.4	4.9	1.7 J	2 U	1 J	1.1 J	1 J	2.1 U	2.4	1.8	3.2	2 U
Cobalt	0.294	--	30	2.3	0.22 J	12 U	1.5 J	9.8 U	9.9 U	0.06 J	0.06 J	0.06 J	0.1 J	11 U	0.14 J	13 U	10 U
Copper	4.83	700	4,100	310	5.6 U	5.9 U	6 U	4.9 U	4.9 U	4.6 U	5.2 U	4.1 U	5.2 U	5.3 U	4.3 U	6.7 U	5 U
Iron	3,245	150	72,000	5,500	2,390 J	1,090 J	2,040 J	856 J	470	756	561	497	946	1,100	915	1,680 J	306
Lead	12.3	270	800	400	7.1	9.2	12.8	6.5	3.8	2.4	3	2.8	5.8	8.2	6.1	7.2	7.1
Manganese	13.7	65	2,300	180	41.3	79.5	60.5	157	15.6	20.7 J	29.6 J	23.8 J	103	84.2	38.4	64.7	19.8
Mercury	0.081	1	31	2.3	0.02 J	0.04 J	0.04 J	0.03 J	0.21 U	0.18 U	0.17 U	0.18 U	0.02 J	0.04 J	0.03 J	0.02 J	0.19 U
Nickel	1.21	130	2,000	150	9 U	9.4 U	9.6 U	7.8 U	7.9 UJ	0.24 J	0.23 J	0.25 J	8.4 U	8.5 UJ	1 J	11 U	8 UJ
Potassium	116	--	--	--	1,100 U	1,200 U	1,200 U	980 U	990 U	920 U	1,000 U	820 U	1,000 U	1,100 U	860 U	1,300 U	1,000 U
Selenium	0.563	2.1	510	39	0.24 J	0.28 J	0.33 J	0.17 J	0.14 J	0.92 U	1 U	0.82 U	1 U	0.2 J	0.86 U	0.27 J	0.13 J
Silver	0.14	3.4	510	39	2.2 U	2.4 U	2.4 U	2 U	2 U	1.8 U	2.1 U	1.6 U	2.1 U	2.1 U	1.7 U	2.7 U	2 U
Sodium	80.9	--	--	--	1,100 UJ	1,200 UJ	1,200 UJ	980 UJ	990 U	920 U	1,000 U	820 U	1,000 U	1,100 U	860 U	1,300 UJ	1,000 U
Vanadium	8.9	--	520	39	6 J	4 J	7.6 J	2.5 J	1.8 J	2.5 J	2.2 J	1.9 J	2.5 J	11 U	3 J	5.4 J	1.5 J
Zinc	10.8	1,200	31,000	2,300	5.7	12	14.1	10.2	4.9	3.7 U	4.1 U	3.3 U	5.4	8.4	6.9	7.5	4.5

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
mg/kg - Milligrams per kilogram
µg/kg - Micrograms per kilogram

TABLE F-1
UXO-02 Surface Soil Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background SS 2X Mean	NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	MR02-SS127	MR02-SS128	MR02-SS129	MR02-SS130	MR02-SS131		MR02-SS132	MR02-SS133	MR02-SS134	MR02-SS135	MR02-SS136	MR02-SS137	MR02-SS138
Sample ID					MR02-SS127-10A	MR02-SS128-10A	MR02-SS129-10A	MR02-SS130-10A	MR02-SS131-10A	MR02-SS131D-10A	MR02-SS132-10A	MR02-SS133-10A	MR02-SS134-10A	MR02-SS135-10A	MR02-SS136-10A	MR02-SS137-10A	MR02-SS138-10A
Sample Date					02/02/10	02/02/10	02/02/10	02/01/10	02/01/10	02/01/10	02/02/10	02/02/10	02/04/10	02/02/10	02/02/10	02/02/10	02/01/10
Chemical Name																	
Semivolatile Organic Compounds (µg/kg)																	
No Detections																	
Explosives (µg/kg)																	
No Detections																	
Total Metals (mg/kg)																	
Aluminum	5,487	--	99,000	7,700	367	775 J	2,980 J	11,300	3,430 J	3,130 J	3,100 J	1,580 J	1,490	1,120 J	979	1,670 J	1,730 J
Antimony	0.447	--	41	3.1	2 UJ	2 UJ	2.3 UJ	2.2 UJ	2.2 UJ	1.9 UJ	2.3 UJ	2.4 UJ	2.3 UJ	1.8 UJ	2.1 UJ	1.6 UJ	2 UJ
Arsenic	0.626	5.8	1.6	0.39	0.22 J	0.5 UJ	0.33 J	0.9 J	0.28 J	0.27 J	0.37 J	0.26 J	0.48 J	0.46 J	0.32 J	0.5 J	0.5 U
Barium	14.5	580	19,000	1,500	11.5 J	7.1 J	36.9 J	47.4	18.8 J	17.5 J	25 J	8 J	45 U	5.3 J	12.9 J	12.5 J	40 U
Beryllium	0.103	--	200	16	1 U	0.99 U	1.1 U	1.1 U	0.08 J	0.08 J	1.2 U	1.2 U	1.1 U	0.93 U	1 U	0.81 U	0.01 J
Cadmium	0.033	3	80	7	0.71 U	0.69 U	0.02 J	0.76 U	0.79 U	0.68 U	0.82 U	0.85 U	0.79 U	0.65 U	0.02 J	0.02 J	0.71 U
Calcium	6,360	--	--	--	1,000 U	990 UJ	2,460 J	1,100 U	1,100 UJ	970 UJ	1,200 U	1,200 U	1,100 UJ	930 UJ	1,000 U	810 UJ	1,000 U
Chromium	6.05	3.8	5.6	0.29	0.62 J	2 U	2.3 U	6.1	2 J	1.9	2.3 U	2.4 U	2.3 U	1.8 U	1 J	1.6 U	1.1 J
Cobalt	0.294	--	30	2.3	0.06 J	0.06 J	0.12 J	0.82 J	0.18 J	0.19 J	12 U	12 U	11 U	0.06 J	0.1 J	0.16 J	0.14 J
Copper	4.83	700	4,100	310	5 U	5 U	5.7 U	5.4 U	5.6 U	4.8 U	5.9 U	6.1 U	5.7 U	4.6 U	5.2 U	4.1 U	5 U
Iron	3,245	150	72,000	5,500	262	306	775	3,130	895	835	1,000	915	1,240	1,010	462	635	563
Lead	12.3	270	800	400	5.2	4.6	6.4	12.5	6.2	6.1	8.2	6.7	3.5	6.5	5.8	5.8	5.2
Manganese	13.7	65	2,300	180	8.7 J	37.3	82.5	30.3	69.4	67.7	74.8	31	21.8	11.2	8.7 J	17	31.7
Mercury	0.081	1	31	2.3	0.14 U	0.02 J	0.02 J	0.02 J	0.03 J	0.02 J	0.04 J	0.05 J	0.18 U	0.02 J	0.02 J	0.02 J	0.02 J
Nickel	1.21	130	2,000	150	0.19 J	0.36 J	9.1 U	8.7 U	1.1 J	1.1 J	9.4 UJ	9.7 UJ	9.1 U	7.4 U	0.38 J	6.5 U	0.52 J
Potassium	116	--	--	--	1,000 U	990 U	1,100 U	1,100 U	1,100 U	970 U	1,200 U	1,200 U	1,100 U	930 U	1,000 U	810 U	56.5 J
Selenium	0.563	2.1	510	39	1 U	0.99 U	1.1 U	0.44 J	0.13 J	0.97 U	0.23 J	1.2 U	0.15 J	0.93 U	1 U	0.13 J	1 U
Silver	0.14	3.4	510	39	2 U	2 U	2.3 U	2.2 U	2.2 U	1.9 U	2.3 U	2.4 U	2.3 U	1.8 U	2.1 U	1.6 U	2 U
Sodium	80.9	--	--	--	1,000 U	990 U	1,100 U	1,100 U	1,100 U	970 U	1,200 U	1,200 U	1,100 U	930 U	1,000 U	810 U	1,000 U
Vanadium	8.9	--	520	39	1.3 J	1.3 J	2.3 J	11 U	2.7 J	2.6 J	12 U	12 U	3.5 J	3.8 J	1.7 J	2.1 J	1.8 J
Zinc	10.8	1,200	31,000	2,300	5.7	4 U	8.8	28.2	7.1	6.9	7.8	5.5	4.5 U	6.6	11.6	3.2 U	4 U

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
mg/kg - Milligrams per kilogram
µg/kg - Micrograms per kilogram

TABLE F-1
UXO-02 Surface Soil Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background SS 2X Mean	NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	MR02-SS139	MR02-SS140	MR02-SS141		MR02-SS142	MR02-SS143	MR02-SS144	MR02-SS145	MR02-SS146	MR02-SS147	MR02-SS148	MR02-SS149	MR02-SS150
Sample ID					MR02-SS139-10A	MR02-SS140-10A	MR02-SS141-10A	MR02-SS141D-10A	MR02-SS142-10A	MR02-SS143-10A	MR02-SS144-10A	MR02-SS145-10A	MR02-SS146-10A	MR02-SS147-10A	MR02-SS148-10A	MR02-SS149-10A	MR02-SS150-10A
Sample Date					02/01/10	02/01/10	02/01/10	02/01/10	02/01/10	02/02/10	02/02/10	02/02/10	02/02/10	02/02/10	02/02/10	02/01/10	02/01/10
Chemical Name																	
Semivolatile Organic Compounds (µg/kg)																	
No Detections																	
Explosives (µg/kg)																	
No Detections																	
Total Metals (mg/kg)																	
Aluminum	5,487	--	99,000	7,700	10,200	3,590 J	1,870 J	1,820 J	1,800 J	2,360 J	1,700 J	743 J	833 J	977 J	2,730 J	4,440 J	1,190 J
Antimony	0.447	--	41	3.1	2.1 UJ	2.4 UJ	1.9 UJ	1.7 UJ	2 UJ	1.5 UJ	1.8 UJ	1.5 UJ	3.4 UJ	1.8 UJ	2 UJ	3.6 UJ	2.2 UJ
Arsenic	0.626	5.8	1.6	0.39	0.69 J	0.65	0.34 J	0.3 J	0.25 J	0.26 J	0.34 J	0.26 J	0.35 J	0.27 J	0.29 J	0.61 J	0.56 U
Barium	14.5	580	19,000	1,500	43.4	39.5 J	7.9 J	7.7 J	24.1 J	6.2 J	7.3 J	5.3 J	45.9 J	10.9 J	12.6 J	92.6	18.2 J
Beryllium	0.103	--	200	16	1.1 U	0.08 J	0.04 J	0.03 J	0.11 J	0.74 U	0.91 U	0.75 U	1.7 U	0.92 U	0.99 U	0.05 J	0.02 J
Cadmium	0.033	3	80	7	0.75 U	0.84 U	0.66 U	0.6 U	0.69 U	0.52 U	0.64 U	0.52 U	0.04 J	0.64 U	0.02 J	1.3 U	0.79 U
Calcium	6,360	--	--	--	1,100 U	1,240	950 UJ	850 UJ	990 UJ	740 U	910 U	750 UJ	1,700 UJ	920 U	990 UJ	4,240 J	1,100 U
Chromium	6.05	3.8	5.6	0.29	5.6	2.9	2.1	2.1	1.3 J	1.5 U	1.8 U	1.5 U	3.4 U	1.8 U	2 U	5.2	0.92 J
Cobalt	0.294	--	30	2.3	0.78 J	0.23 J	0.12 J	0.11 J	0.09 J	7.4 U	9.1 U	7.5 U	0.08 J	9.2 U	0.14 J	0.24 J	0.07 J
Copper	4.83	700	4,100	310	5.4 U	6 U	4.7 U	4.3 U	5 U	3.7 U	4.6 U	3.8 U	8.4 U	4.6 U	4.9 U	9 U	5.6 U
Iron	3,245	150	72,000	5,500	2,840	1,530	853	815	578	965	843	669	435	560	672	1,840	383
Lead	12.3	270	800	400	11.1	8.4	6.1	5.7	6.4	3.9	7.9	11.8	9	4.4	6.6	5.9	3.3
Manganese	13.7	65	2,300	180	30.1	134	19.6	15	62.1	34.4	43.5	7.2	27	22.2	63.1	594	69.2
Mercury	0.081	1	31	2.3	0.02 J	0.05 J	0.02 J	0.02 J	0.03 J	0.02 J	0.03 J	0.02 J	0.04 J	0.21 U	0.03 J	0.05 J	0.04 J
Nickel	1.21	130	2,000	150	8.6 U	1.2 J	0.66 J	0.68 J	0.84 J	5.9 UJ	7.3 UJ	6 U	13 U	7.4 UJ	7.9 U	1.4 J	0.43 J
Potassium	116	--	--	--	1,100 U	192 J	950 U	850 U	990 U	740 U	910 U	750 U	1,700 U	920 U	990 U	1,800 U	140 J
Selenium	0.563	2.1	510	39	0.38 J	1.2 U	0.95 U	0.85 U	0.13 J	0.11 J	0.91 U	0.13 J	0.26 J	0.92 U	0.14 J	1.8 U	1.1 U
Silver	0.14	3.4	510	39	2.1 U	2.4 U	1.9 U	1.7 U	2 U	1.5 U	1.8 U	1.5 U	3.4 U	1.8 U	2 U	3.6 U	2.2 U
Sodium	80.9	--	--	--	1,100 U	1,200 U	950 U	850 U	990 U	740 U	910 U	750 U	1,700 U	920 U	990 U	1,800 U	1,100 U
Vanadium	8.9	--	520	39	11 U	4.8 J	3.2 J	3.1 J	1.8 J	1.9 J	9.1 U	1.8 J	1.7 J	2.3 J	2 J	6.3 J	1.5 J
Zinc	10.8	1,200	31,000	2,300	25	14.2	3.3 J	3 J	6.3	3 U	4.1	3 U	7.9	4	6.1	30.3	5.2

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
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J - Analyte present, value may or may not be accurate or precise
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µg/kg - Micrograms per kilogram

TABLE F-1
UXO-02 Surface Soil Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background SS 2X Mean	NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	MR02-SS151		MR02-SS152	MR02-SS153	MR02-SS154	MR02-SS155	MR02-SS156	MR02-SS157	MR02-SS158	MR02-SS159	MR02-SS160	MR02-SS161	
Sample ID					MR02-SS151-10A	MR02-SS151D-10A	MR02-SS152-10A	MR02-SS153-10A	MR02-SS154-10A	MR02-SS155-10A	MR02-SS156-10A	MR02-SS157-10A	MR02-SS158-10A	MR02-SS159-10A	MR02-SS160-10A	MR02-SS161-10A	MR02-SS161D-10A
Sample Date					02/01/10	02/01/10	02/01/10	02/01/10	02/01/10	02/02/10	02/02/10	02/02/10	02/02/10	02/02/10	02/02/10	02/01/10	02/01/10
Chemical Name																	
Semivolatile Organic Compounds (µg/kg)																	
No Detections																	
Explosives (µg/kg)																	
No Detections																	
Total Metals (mg/kg)																	
Aluminum	5,487	--	99,000	7,700	1,370 J	1,430 J	2,420 J	1,150 J	2,150 J	1,830 J	1,480 J	4,020 J	1,370 J	601 J	2,370 J	1,050 J	859 J
Antimony	0.447	--	41	3.1	2.4 UJ	2.3 UJ	1.8 UJ	0.17 J	2 UJ	2.3 UJ	1.9 UJ	1.6 UJ	2.5 UJ	1.9 UJ	1.9 UJ	1.9 UJ	2 UJ
Arsenic	0.626	5.8	1.6	0.39	0.34 J	<u>0.4 J</u>	0.27 J	0.22 J	0.27 J	<u>0.44 J</u>	<u>0.41 J</u>	0.75 J	0.39 J	0.2 J	0.29 J	0.47 U	0.49 U
Barium	14.5	580	19,000	1,500	10.5 J	11.3 J	37.9	12 J	8.1 J	17 J	13.3 J	3.6 J	25.9 J	7.3 J	13.2 J	10.8 J	10.6 J
Beryllium	0.103	--	200	16	0.01 J	0.01 J	0.07 J	0.02 J	0.02 J	1.1 U	0.96 U	0.79 U	1.2 U	0.94 U	0.97 U	0.02 J	0.02 J
Cadmium	0.033	3	80	7	0.85 U	0.81 U	0.65 U	0.77 U	0.69 U	0.79 U	0.67 U	0.56 U	0.88 U	0.66 U	0.02 J	0.66 U	0.68 U
Calcium	6,360	--	--	--	1,200 U	1,200 U	1,290	1,100 UJ	990 UJ	1,160	960 U	790 UJ	1,200 U	940 U	970 UJ	940 UJ	980 UJ
Chromium	6.05	3.8	5.6	0.29	<u>1.3 J</u>	<u>1.4 J</u>	<u>1.9</u>	2.2 U	2 U	2.3 U	1.9 U	4	2.5 U	1.9 U	1.9 U	1.9 U	2 U
Cobalt	0.294	--	30	2.3	0.05 J	0.08 J	0.18 J	0.08 J	0.05 J	11 U	9.6 U	0.06 J	12 U	9.4 U	0.1 J	0.04 J	0.04 J
Copper	4.83	700	4,100	310	6.1 U	5.8 U	4.6 U	5.5 U	4.9 U	5.6 U	4.8 U	4 U	6.3 U	4.7 U	4.8 U	4.7 U	4.9 U
Iron	3,245	150	72,000	5,500	1,230	1,240	819	383	1,020	1,120	650	2,700	598	357	827	479	413
Lead	12.3	270	800	400	5.8	6.6	5.8	4.5	4.7	5.8	13	3.3	10.1	4	10.1	4.8	4.2
Manganese	13.7	65	2,300	180	35.6	42.7	86.2	64.3	35.9	91.3	17.6	10.6	9.2	11.7	34.6	59.1	53.1
Mercury	0.081	1	31	2.3	0.04 J	0.03 J	0.03 J	0.04 J	0.03 J	0.05 J	0.05 J	0.01 J	0.23 U	0.18 U	0.04 J	0.01 J	0.19 U
Nickel	1.21	130	2,000	150	0.44 J	0.52 J	0.99 J	0.6 J	0.68 J	9 UJ	7.7 UJ	0.67 J	10 UJ	7.5 UJ	7.8 U	0.42 J	0.36 J
Potassium	116	--	--	--	160 J	125 J	182 J	1,100 U	990 U	1,100 U	960 U	790 U	1,200 U	940 U	970 U	940 U	980 U
Selenium	0.563	2.1	510	39	1.2 U	1.2 U	0.92 U	1.1 U	0.99 U	0.26 J	0.19 J	0.2 J	0.22 J	0.12 J	0.14 J	0.94 U	0.98 U
Silver	0.14	3.4	510	39	2.4 U	2.3 U	1.8 U	2.2 U	2 U	2.3 U	1.9 U	1.6 U	2.5 U	1.9 U	1.9 U	1.9 U	2 U
Sodium	80.9	--	--	--	1,200 U	1,200 U	920 U	1,100 U	990 U	1,100 U	960 U	790 U	1,200 U	940 U	970 U	940 U	980 U
Vanadium	8.9	--	520	39	3.2 J	3.3 J	2.6 J	1.4 J	2.9 J	11 U	9.6 U	7.5 J	2.9 J	1.4 J	3 J	1.6 J	1.4 J
Zinc	10.8	1,200	31,000	2,300	5.9	4.9	11.1	2.6 J	2.6 J	4.5	3.8 U	3.2 U	5 U	3.7 U	4.5	3.8	3.1 J

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
mg/kg - Milligrams per kilogram
µg/kg - Micrograms per kilogram

TABLE F-1
UXO-02 Surface Soil Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background SS 2X Mean	NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	MR02-SS162	MR02-SS163	MR02-SS164	MR02-SS165	MR02-SS166	MR02-SS167	MR02-SS168	MR02-SS169	MR02-SS170	MR02-SS171		MR02-SS172	MR02-SS173
Sample ID					MR02-SS162-10A	MR02-SS163-10A	MR02-SS164-10A	MR02-SS165-10A	MR02-SS166-10A	MR02-SS167-10A	MR02-SS168-10A	MR02-SS169-10A	MR02-SS170-10A	MR02-SS171-10A	MR02-SS171D-10A	MR02-SS172-10A	MR02-SS173-10A
Sample Date					02/01/10	02/01/10	02/01/10	02/01/10	02/01/10	02/02/10	02/02/10	02/02/10	02/02/10	02/02/10	02/02/10	02/02/10	02/02/10
Chemical Name																	
Semivolatile Organic Compounds (µg/kg)																	
No Detections																	
Explosives (µg/kg)																	
No Detections																	
Total Metals (mg/kg)																	
Aluminum	5,487	--	99,000	7,700	1,250 J	314 J	212 J	992 J	1,650 J	1,650 J	1,540 J	3,240 J	5,130 J	1,490 J	1,090 J	843 J	602 J
Antimony	0.447	--	41	3.1	1.7 UJ	2 UJ	1.7 UJ	1.9 UJ	2.7 UJ	2 UJ	1.8 UJ	1.8 UJ	2.5 UJ	4.4 UJ	3 UJ	2.4 UJ	3.1 UJ
Arsenic	0.626	5.8	1.6	0.39	0.29 J	0.51 U	0.43 U	0.27 J	0.34 J	0.36 J	0.31 J	0.37 J	0.46 J	0.68 J	0.58 J	0.59 UJ	0.37 J
Barium	14.5	580	19,000	1,500	7.9 J	9.2 J	34 U	5.4 J	7.8 J	5.6 J	5.9 J	26.8 J	31 J	72.4 J	58.3 J	6.1 J	30 J
Beryllium	0.103	--	200	16	0.86 U	1 U	0.85 U	0.96 U	1.3 U	0.99 U	0.91 U	0.88 U	1.2 U	2.2 U	1.5 U	1.2 U	1.6 U
Cadmium	0.033	3	80	7	0.6 U	0.72 U	0.6 U	0.01 J	0.94 U	0.69 U	0.64 U	0.62 U	0.86 U	0.03 J	1 U	0.83 U	0.03 J
Calcium	6,360	--	--	--	860 U	1,000 UJ	850 U	960 UJ	1,300 UJ	990 U	910 U	1,270	1,290	3,540 J	2,680 J	1,200 UJ	2,060 J
Chromium	6.05	3.8	5.6	0.29	1.5 J	0.45 J	0.34 J	1.9 U	1.5 J	2 U	1.8 U	1.8	2.5 U	4.4 U	3 U	2.4 U	3.1 U
Cobalt	0.294	--	30	2.3	0.08 J	10 U	0.04 J	0.03 J	0.1 J	9.9 U	9.1 U	8.8 U	0.52 J	0.32 J	0.17 J	0.05 J	0.1 J
Copper	4.83	700	4,100	310	4.3 U	5.1 U	4.3 U	4.8 U	6.7 U	5 U	4.6 U	4.4 U	6.2 U	11 U	7.4 U	5.9 U	7.8 U
Iron	3,245	150	72,000	5,500	847	154	141	765	868	836	927	931	1,160	912	725	415	450
Lead	12.3	270	800	400	3.4	4.9	2.4	4	5.2	6.2	5.5	6.4	12.1	27.6	20.6	6.3	11
Manganese	13.7	65	2,300	180	23.2	19.5	10	11	26.5	27.3	24.8	119	84.3	30.3	22.1	12.2	33.4
Mercury	0.081	1	31	2.3	0.02 J	0.01 J	0.02 J	0.02 J	0.04 J	0.03 J	0.03 J	0.04 J	0.05 J	0.14 J	0.12 J	0.02 J	0.06 J
Nickel	1.21	130	2,000	150	0.28 J	0.3 J	0.2 J	7.7 U	0.95 J	7.9 UJ	7.3 UJ	7.1 UJ	9.9 UJ	18 U	12 U	9.5 U	12 U
Potassium	116	--	--	--	81.6 J	1,000 U	32.3 J	960 U	1,300 U	990 U	910 U	880 U	1,200 U	2,200 U	1,500 U	1,200 U	1,600 U
Selenium	0.563	2.1	510	39	0.86 U	1 U	0.85 U	0.96 U	0.26 J	0.99 U	0.17 J	0.2 J	0.37 J	0.39 J	0.33 J	1.2 U	1.6 U
Silver	0.14	3.4	510	39	1.7 U	2 U	1.7 U	1.9 U	2.7 U	2 U	1.8 U	1.8 U	2.5 U	4.4 U	3 U	2.4 U	3.1 U
Sodium	80.9	--	--	--	860 U	1,000 U	850 U	960 U	1,300 U	990 U	910 U	960 U	1,200 U	2,200 U	1,500 U	1,200 U	1,600 U
Vanadium	8.9	--	520	39	2.8 J	0.76 J	0.68 J	2.4 J	3 J	9.9 U	9.1 U	8.8 U	12 U	4.8 J	3.3 J	2 J	2.2 J
Zinc	10.8	1,200	31,000	2,300	3.4 U	1.4 J	3.4 U	3.8 U	5.6	4 U	5.2	6.4	11.1	27 J	11 J	4.7 U	8.5

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
mg/kg - Milligrams per kilogram
µg/kg - Micrograms per kilogram

TABLE F-1
UXO-02 Surface Soil Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background SS 2X Mean	NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	MR02-SS174	MR02-SS175	MR02-SS176	MR02-SS177	MR02-SS178	MR02-SS179	MR02-SS180	MR02-SS181		MR02-SS182	MR02-SS183	MR02-SS184
Sample ID					MR02-SS174-10A	MR02-SS175-10A	MR02-SS176-10A	MR02-SS177-10A	MR02-SS178-10A	MR02-SS179-10A	MR02-SS180-10A	MR02-SS181-10A	MR02-SS181D-10A	MR02-SS182-10A	MR02-SS183-10A	MR02-SS184-10A
Sample Date					02/01/10	02/01/10	02/01/10	02/01/10	02/01/10	02/01/10	02/02/10	02/02/10	02/02/10	02/02/10	02/01/10	02/01/10
Chemical Name																
Semivolatile Organic Compounds (µg/kg)																
No Detections																
Explosives (µg/kg)																
No Detections																
Total Metals (mg/kg)																
Aluminum	5,487	--	99,000	7,700	1,290 J	652 J	993 J	664 J	1,430 J	1,200 J	1,150 J	332 J	319 J	320 J	8,670 J	1,830 J
Antimony	0.447	--	41	3.1	2.3 UJ	2.6 UJ	4.7 UJ	3 UJ	2 UJ	2.2 UJ	1.4 UJ	1.9 UJ	2.1 UJ	1.8 UJ	0.12 J	1.8 UJ
Arsenic	0.626	5.8	1.6	0.39	0.21 J	0.66 U	1.2 U	0.76 U	0.32 J	0.32 J	0.33 J	0.18 J	0.24 J	0.16 J	0.53	0.36 J
Barium	14.5	580	19,000	1,500	10.4 J	53 U	21.8 J	8.7 J	6.4 J	5.8 J	7.6 J	14.6 J	14.4 J	3.3 J	14.9 J	7.1 J
Beryllium	0.103	--	200	16	1.2 U	1.3 U	2.4 U	1.5 U	1 U	0.01 J	0.68 U	0.94 U	1 U	0.92 U	0.09 J	0.02 J
Cadmium	0.033	3	80	7	0.81 U	0.93 U	0.13 J	1 U	0.7 U	0.76 U	0.48 U	0.66 U	0.73 U	0.64 U	0.63 U	0.61 U
Calcium	6,360	--	--	--	1,200 UJ	1,300 U	2,400 UJ	1,500 U	1,000 UJ	1,100 UJ	680 U	940 U	1,000 U	920 UJ	1,250 J	4,580 J
Chromium	6.05	3.8	5.6	0.29	2.3 U	0.81 J	1.3 J	0.91 J	2 U	2.2 U	1.4 U	1.9 U	2.1 U	1.8 U	8.5	2.4
Cobalt	0.294	--	30	2.3	0.04 J	0.1 J	0.15 J	0.13 J	0.05 J	11 U	6.8 U	9.4 U	10 U	9.2 U	0.48 J	0.22 J
Copper	4.83	700	4,100	310	5.8 U	6.6 U	12 U	7.6 U	5 U	5.4 U	3.4 U	4.7 U	5.2 U	4.6 U	7.8	7.4
Iron	3,245	150	72,000	5,500	468	294	325	434	724	774	695	164	157	286	2,650	1,060
Lead	12.3	270	800	400	3.9	10.3	6.6	8.3	5	3.7	5	2.2	2.2	3.1	7.2	4.8
Manganese	13.7	65	2,300	180	29.3	30.1	57.2	5.9	8.4	8.2	21.3	5.2	5.5	7.5	20.2	14.3
Mercury	0.081	1	31	2.3	0.02 J	0.05 J	0.1 J	0.05 J	0.03 J	0.18 U	0.02 J	0.18 U	0.16 U	0.01 J	0.19 U	0.01 J
Nickel	1.21	130	2,000	150	0.52 J	0.62 J	1.2 J	0.66 J	0.44 J	0.37 J	5.4 UJ	7.5 UJ	8.3 UJ	7.3 U	2.3 J	1.2 J
Potassium	116	--	--	--	1,200 U	110 J	2,400 U	162 J	1,000 U	1,100 U	680 U	940 U	1,000 U	920 U	900 U	880 U
Selenium	0.563	2.1	510	39	1.2 U	1.3 U	0.34 J	0.22 J	1 U	0.12 J	0.11 J	0.11 J	1 U	0.92 U	0.14 J	0.88 U
Silver	0.14	3.4	510	39	2.3 U	2.6 U	4.7 U	3 U	2 U	2.2 U	1.4 U	1.9 U	2.1 U	1.8 U	1.8 U	1.8 U
Sodium	80.9	--	--	--	1,200 U	1,300 U	2,400 U	1,500 U	1,000 U	1,100 U	680 U	940 U	1,000 U	920 U	900 U	880 U
Vanadium	8.9	--	520	39	1.8 J	1.5 J	1.8 J	1.5 J	2.3 J	2.6 J	2.2 J	0.54 J	0.48 J	1 J	9.7	3 J
Zinc	10.8	1,200	31,000	2,300	3.2 J	9.5	21.2	6 U	4.1	1.6 J	2.7 U	3.8 U	4.2 U	6.5	19.7	18.2

Notes:

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Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
mg/kg - Milligrams per kilogram
µg/kg - Micrograms per kilogram

TABLE F-2
IR69 Surface Soil Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID Sample ID Sample Date	Camp Lejeune Background SS 2X Mean	NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	MR02-IR69-SS01		MR02-IR69-SS02	MR02-IR69-SS03	MR02-IR69-SS04	MR02-IR69-SS05	MR02-IR69-SS06	MR02-IR69-SS07
					MR02-IR69-SS01-10A	MR02-IR69-SS01D-10A	MR02-IR69-SS02-10A	MR02-IR69-SS03-10A	MR02-IR69-SS04-10A	MR02-IR69-SS05-10A	MR02-IR69-SS06-10A	MR02-IR69-SS07-10A
					03/04/10	03/04/10	03/13/10	03/13/10	03/13/10	03/13/10	03/13/10	03/13/10
Chemical Name												
Semivolatile Organic Compounds (µg/kg)												
No Detections												NA
Explosives (µg/kg)												
Nitroglycerin	--	--	6,200	610	880 U	1,400 U	850 U	930 U	870 U	890 U	960 U	980 U
Total Metals (mg/kg)												
Aluminum	5,487	--	99,000	7,700	3,550	3,760	2,970	1,140	1,480	1,320	1,460	3,460
Antimony	0.447	--	41	3.1	2 UJ	2.7 UJ	2.2 UJ	0.12 J	2.5 UJ	2 UJ	2.4 UJ	2.1 UJ
Arsenic	0.626	5.8	1.6	0.39	<u>0.45 J</u>	<u>0.44 J</u>	<u>0.45 J</u>	0.27 J	<u>0.51 J</u>	0.24 J	<u>0.42 J</u>	<u>0.94</u>
Barium	14.5	580	19,000	1,500	30.8 J	29.6 J	13.7 J	6.4 J	21.4 J	6.9 J	5 J	9.6 J
Calcium	6,360	--	--	--	980 U	1,300 U	1,100 U	1,100 U	1,200 U	1,000 U	1,200 U	1,000 U
Chromium	6.05	3.8	5.6	0.29	2.2	2.7 U	2.3	2.2 U	2.5 U	2 U	2.4 U	4.4
Copper	4.83	700	4,100	310	4.9 U	6.7 U	5.4 U	5.4 U	6.2 U	5 U	6.1 U	5.3 U
Iron	3,245	150	72,000	5,500	1,030	1,110	977	469	559	587	797	2,490
Lead	12.3	270	800	400	7.4	7.7	8.4	4	5.3	2.9	3.2	3.8
Manganese	13.7	65	2,300	180	57.2	48.4	60.4	12	34.3	47.5	27.5	17.5
Mercury	0.081	1	31	2.3	0.03 J	0.04 J	0.02 J	0.03 J	0.04 J	0.19 U	0.03 J	0.03 J
Potassium	116	--	--	--	197 J	170 J	107 J	63.8 J	101 J	74.3 J	91.8 J	194 J
Selenium	0.563	2.1	510	39	0.11 J	1.3 U	0.13 J	1.1 U	1.2 U	1 U	1.2 U	1 U
Sodium	80.9	--	--	--	980 U	1,300 U	1,100 U	1,100 U	1,200 U	1,000 U	1,200 U	1,000 U
Thallium	0.36	--	--	--	0.05 J	0.04 J	0.03 J	0.54 U	0.62 U	0.5 U	0.61 U	0.02 J
Vanadium	8.9	--	520	39	3.9 J	4.2 J	3.9 J	2.2 J	2.6 J	2.1 J	2.9 J	7.6 J
Zinc	10.8	1,200	31,000	2,300	14.4	13.3	11.1	4.4 U	5 U	4 U	4.8 U	4.3

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
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NA - Not analyzed
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TABLE F-2
IR69 Surface Soil Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background SS 2X Mean	NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	MR02-IR69-SS08	MR02-IR69-SS09	MR02-IR69-SS10	MR02-IR69-SS11		MR02-IR69-SS12	MR02-IR69-SS13	MR02-IR69-SS14
Sample ID					MR02-IR69-SS08-10A	MR02-IR69-SS09-10A	MR02-IR69-SS10-10A	MR02-IR69-SS11-10A	MR02-IR69-SS11D-10A	MR02-IR69-SS12-10A	MR02-IR69-SS13-10A	MR02-IR69-SS14-10A
Sample Date					02/25/10	02/25/10	02/25/10	02/25/10	02/25/10	02/24/10	02/23/10	02/23/10
Chemical Name												
Semivolatile Organic Compounds (µg/kg)												
No Detections					NA	NA	NA	NA	NA	NA	NA	NA
Explosives (µg/kg)												
Nitroglycerin	--	--	6,200	610	900 U	850 U	860 U	1,100 U	1,200 U	1,000 U	850 U	1,200 U
Total Metals (mg/kg)												
Aluminum	5,487	--	99,000	7,700	1,890 J	1,970 J	2,080 J	2,030 J	2,190 J	1,860 J	1,940 J	1,740 J
Antimony	0.447	--	41	3.1	1.8 UJ	2 UJ	1.9 UJ	2.6 UJ	2.2 UJ	2.6 UJ	1.7 UJ	0.4 J
Arsenic	0.626	5.8	1.6	0.39	<u>0.41</u> J	<u>0.43</u> J	<u>0.46</u> J	<u>0.48</u> J	<u>0.59</u>	<u>0.51</u> J	0.24 J	<u>0.52</u> J
Barium	14.5	580	19,000	1,500	36 U	41 U	38 U	53 U	45 U	52 U	34 U	59 U
Calcium	6,360	--	--	--	900 U	1,000 U	950 U	1,300 U	1,100 U	1,300 U	860 U	1,500 U
Chromium	6.05	3.8	5.6	0.29	<u>1.6</u> J	<u>1.6</u> J	<u>1.6</u> J	<u>1.7</u> J	<u>1.9</u> J	<u>1.8</u> J	<u>1.6</u> J	<u>1.9</u> J
Copper	4.83	700	4,100	310	4.5 U	5.1 U	4.8 U	6.6 U	5.6 U	2.4 J	1.2 J	2.3 J
Iron	3,245	150	72,000	5,500	1,090	1,100	1,240	1,140	1,330	1,070	922	1,050
Lead	12.3	270	800	400	3.6	2.2	3.2	3.5	4.7	3.6	3.1	4.5
Manganese	13.7	65	2,300	180	9	16.9	10.7	12.6	12.1	30.1	8.1	18
Mercury	0.081	1	31	2.3	0.19 U	0.17 U	0.18 U	0.21 U	0.17 U	0.24 U	0.15 U	0.23 U
Potassium	116	--	--	--	58.8 J	45.9 J	47.9 J	92.9 J	90.8 J	152 J	43 J	122 J
Selenium	0.563	2.1	510	39	0.9 U	1 U	0.95 U	1.3 U	0.16 J	1.3 U	0.86 U	1.5 U
Sodium	80.9	--	--	--	7.4 J	5.3 J	5.4 J	19.9 J	19.1 J	1,300 U	860 U	1,500 U
Thallium	0.36	--	--	--	0.45 U	0.51 U	0.48 U	0.66 U	0.56 U	0.65 U	0.43 U	0.74 U
Vanadium	8.9	--	520	39	9 U	10 U	9.5 U	13 U	11 U	13 U	8.6 U	15 U
Zinc	10.8	1,200	31,000	2,300	3.6 U	4.1 U	3.8 U	5.3 U	4.5 U	31.2	3.4 U	10.1

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs

Underline indicates exceedance of Adjusted Residential Soil RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

mg/kg - Milligrams per kilogram

µg/kg - Micrograms per kilogram

TABLE F-2
IR69 Surface Soil Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background SS 2X Mean	NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	MR02-IR69-SS15	MR02-IR69-SS16	MR02-IR69-SS17	MR02-IR69-SS18	MR02-IR69-SS19	MR02-IR69-SS20	MR02-IR69-SS21	
Sample ID					MR02-IR69-SS15-10A	MR02-IR69-SS16-10A	MR02-IR69-SS17-10A	MR02-IR69-SS18-10A	MR02-IR69-SS19-10A	MR02-IR69-SS20-10A	MR02-IR69-SS21-10A	MR02-IR69-SS21D-10A
Sample Date					02/24/10	02/24/10	02/24/10	02/24/10	02/24/10	02/25/10	02/25/10	02/25/10
Chemical Name												
Semivolatile Organic Compounds (µg/kg)												
No Detections					NA	NA	NA	NA	NA	NA	NA	NA
Explosives (µg/kg)												
Nitroglycerin	--	--	6,200	610	1,300 U	900 U	<u>860</u> ↓	1,300 U	1,700 U	1,200 U	1,000 U	1,000 U
Total Metals (mg/kg)												
Aluminum	5,487	--	99,000	7,700	3,600 J	2,820 J	1,640 J	1,380 J	2,120 J	808 J	1,350 J	1,290 J
Antimony	0.447	--	41	3.1	3 UJ	2.1 UJ	2.2 UJ	2.9 UJ	3.8 UJ	2.8 UJ	2 UJ	2.5 UJ
Arsenic	0.626	5.8	1.6	0.39	<u>1.6</u>	<u>0.61</u>	<u>0.5</u> ↓	<u>0.62</u> ↓	<u>0.6</u> ↓	0.34 J	<u>0.54</u>	<u>0.47</u> ↓
Barium	14.5	580	19,000	1,500	60 U	43 U	44 U	57 U	75 U	56 U	40 U	49 U
Calcium	6,360	--	--	--	39,700	1,100 U	1,100 U	1,400 U	1,900 U	1,400 U	1,000 U	1,200 U
Chromium	6.05	3.8	5.6	0.29	12	2.8	<u>1.6</u> ↓	2 ↓	<u>1.6</u> ↓	<u>0.99</u> ↓	<u>1.4</u> ↓	<u>1.7</u> ↓
Copper	4.83	700	4,100	310	5.6 J	1.6 J	2.2 J	2.8 J	4.3 J	3.2 J	5.1 U	6.2 U
Iron	3,245	150	72,000	5,500	4,530	2,090	825	1,120	660	472	1,590	1,640
Lead	12.3	270	800	400	3.2	4	221	7.5	10.2	6	3.9	3.5
Manganese	13.7	65	2,300	180	141	7.4	60.9	27.4	36.9	21.5	5.9	6.6
Mercury	0.081	1	31	2.3	0.25 U	0.18 U	0.19 U	0.28 U	0.33 U	0.25 U	0.15 U	0.16 U
Potassium	116	--	--	--	591 J	78.6 J	98.2 J	111 J	133 J	152 J	50.6 J	51.8 J
Selenium	0.563	2.1	510	39	0.54 J	1.1 U	1.1 U	0.23 J	1.9 U	1.4 U	1 U	1.2 U
Sodium	80.9	--	--	--	1,500 U	1,100 U	1,100 U	1,400 U	1,900 U	39.8 J	7.8 J	6.3 J
Thallium	0.36	--	--	--	0.76 U	0.53 U	0.56 U	0.72 U	0.94 U	0.71 U	0.51 U	0.62 U
Vanadium	8.9	--	520	39	16.9	11 U	11 U	14 U	19 U	14 U	10 U	12 U
Zinc	10.8	1,200	31,000	2,300	27.7	4.3 U	6.3	5.7 U	8.4	10.1	7.8	6.7

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
mg/kg - Milligrams per kilogram
µg/kg - Micrograms per kilogram

TABLE F-3
UXO-02 Subsurface Soil Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background SB 2X Mean	NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	MR02-TW01/IS01	MR02-TW02/IS02	MR02-TW03/IS03	MR02-TW04/IS04	MR02-TW06/IS06	MR02-TW08/IS08	MR02-TW09/IS09	MR02-TW10/IS10	MR02-TW11/IS11	
Sample ID					MR02-IS01-6-7-10A	MR02-IS02-5-6-10A	MR02-IS03-2-3-10A	MR02-IS04-5-6-10A	MR02-IS06-3-4-10A	MR02-IS08-4-5-10A	MR02-IS09-8-9-10A	MR02-IS10-2-3-10A	MR02-IS11-5-6-10A	MR02-IS11D-5-6-10A
Sample Date					03/23/10	03/23/10	03/23/10	03/23/10	03/23/10	03/23/10	03/23/10	03/24/10	03/24/10	03/24/10
Chemical Name														
Semivolatile Organic Compounds (µg/kg)														
No Detections					NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (µg/kg)														
No Detections					NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (mg/kg)														
Aluminum	10,369	--	99,000	7,700	<u>20,500</u>	<u>24,000</u>	<u>23,100</u>	<u>19,400</u>	3,520	<u>13,500</u>	<u>21,000</u>	<u>9,210</u>	743 J	447 J
Antimony	0.36	--	41	3.1	2 UJ	2 UJ	2.1 UJ	1.9 UJ	1.4 UJ	2 UJ	2.5 UJ	2.2 UJ	2 UJ	2.2 UJ
Arsenic	2.12	5.8	1.6	0.39	3.8	5.5	4.5	3.5	0.26 J	1.9	1.1	0.3 J	0.5 U	0.55 U
Barium	16.6	580	19,000	1,500	23.7 J	21.4 J	28.3 J	20.1 J	11.7 J	30.2 J	20.4 J	7 J	3 J	2.5 J
Cadmium	0.023	3	80	7	0.7 U	0.68 U	0.73 U	0.66 U	0.49 U	0.71 U	0.87 U	0.76 U	0.7 U	0.76 U
Chromium	14.5	3.8	5.6	0.29	30.5	33.9	25.6	26.5	4.5	11.6	27.9	8.6	2 U	2.2 U
Cobalt	0.822	--	30	2.3	10 U	9.8 U	10 U	0.82 J	7.1 U	10 U	12 U	0.38 J	10 U	11 U
Copper	2.56	700	4,100	310	5 U	4.9 U	5.2 U	5.7	3.5 U	5.1 U	6.2 U	5.4 U	5 U	5.5 U
Iron	5,439	150	72,000	5,500	<u>9,330 J</u>	<u>16,100 J</u>	<u>9,870 J</u>	<u>10,800 J</u>	1,150 J	5,120 J	<u>6,850 J</u>	1,330 J	289 J	193 J
Lead	8.49	270	800	400	7.6	7.7	5.7	7.4	3	5.8	7.3	4	1.2	1.6
Magnesium	363	--	--	--	1,330 J	1,230 J	1,000 U	1,150 J	710 U	1,000 U	1,200 U	1,100 U	1,000 U	1,100 U
Manganese	9.25	65	2,300	180	27.6	22	19	24	11.1	19.5	24.6	6.6	6.8	4.8
Mercury	0.071	1	31	2.3	0.19 U	0.21 U	0.01 J	0.21 U	0.15 U	0.01 J	0.19 U	0.02 J	0.15 U	0.16 U
Nickel	2.27	130	2,000	150	8 U	7.8 U	8.4 U	7.5 U	5.6 U	8.1 U	9.9 U	8.7 U	8 U	8.7 U
Potassium	361	--	--	--	1,140 J	1,470 J	1,270 J	1,460 J	239 J	656 J	1,520 J	250 J	45.7 J	38.7 J
Selenium	0.505	2.1	510	39	0.35 J	0.48 J	0.51 J	0.26 J	0.08 J	0.3 J	0.11 J	0.28 J	1 U	0.05 J
Silver	0.129	3.4	510	39	2 U	2 U	2.1 U	1.9 U	1.4 U	2 U	2.5 U	2.2 U	2 U	2.2 U
Thallium	0.38	--	--	--	0.15 J	0.17 J	0.16 J	0.15 J	0.02 J	0.11 J	0.11 J	0.05 J	0.5 U	0.02 J
Vanadium	17.2	--	520	39	31	34.6	33.1	27.8	4.6 J	17.2	29.5	11 U	10 U	11 U
Zinc	6.59	1,200	31,000	2,300	13.5	17	11.7	15.7	2.8 U	13.4	19.5	4.3 U	4 U	4.4 U

Notes:

Shading indicates exceedance of two times the mean base background concentration for subsurface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
mg/kg - Milligrams per kilogram
µg/kg - Micrograms per kilogram

TABLE F-3
UXO-02 Subsurface Soil Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background SB	NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	MR02-TW12/IS12	MR02-TW13/IS13	MR02-TW14/IS14	MR02-TW15/IS15	MR02-TW16/IS16	MR02-TW17/IS17	MR02-TW18/IS18	MR02-TW19/IS19	MR02-TW20/IS20	MR02-TW21/IS21	
Sample ID	2X Mean				MR02-IS12-5-6-10A	MR02-IS13-2-3-10A	MR02-IS14-2-3-10A	MR02-IS15-4-5-10A	MR02-IS16-5-6-10A	MR02-IS17-5-6-10A	MR02-IS18-2-3-10A	MR02-IS19-2-3-10A	MR02-IS20-3-4-10A	MR02-IS21-5-6-10A	MR02-IS21D-5-6-10A
Sample Date					03/24/10	03/24/10	03/25/10	03/25/10	03/24/10	03/22/10	03/22/10	03/25/10	03/22/10	03/25/10	03/25/10
Chemical Name															
Semivolatile Organic Compounds (µg/kg)															
No Detections					NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (µg/kg)															
No Detections					NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (mg/kg)															
Aluminum	10,369	--	99,000	7,700	1,160	7,640	1,900	997	1,080	<u>17,700</u>	2,270	1,750	2,060	<u>16,600</u>	<u>20,500</u>
Antimony	0.36	--	41	3.1	2.2 UJ	1.5 UJ	1.9 UJ	2.2 UJ	1.6 UJ	2.2 UJ	2 UJ	2.1 UJ	2.2 UJ	1.9 UJ	1.9 UJ
Arsenic	2.12	5.8	1.6	0.39	0.54 U	0.36 J	0.47 U	0.54 U	0.12 J	5.5	0.51 U	0.52 U	0.18 J	2.9	4.1
Barium	16.6	580	19,000	1,500	2 J	5 J	3.2 J	1.9 J	4 J	23.6 J	4.4 J	3.8 J	2.5 J	18.6 J	23.2 J
Cadmium	0.023	3	80	7	0.75 U	0.52 U	0.65 U	0.76 U	0.56 U	0.08 J	0.72 U	0.72 U	0.76 U	0.68 U	0.67 U
Chromium	14.5	3.8	5.6	0.29	2.2 U	6.5	<u>2.4</u>	2.2 U	<u>2</u>	35	<u>2.2</u>	2.1 U	<u>2.9</u>	18.7	25.7
Cobalt	0.822	--	30	2.3	11 U	0.13 J	9.3 U	11 U	0.04 J	1.3 J	0.12 J	10 U	11 U	0.82 J	0.77 J
Copper	2.56	700	4,100	310	5.4 U	3.7 U	4.7 U	5.4 U	4 U	6.3	5.1 U	5.2 U	5.4 U	4.8 U	4.8 U
Iron	5,439	150	72,000	5,500	290 J	668 J	861 J	450 J	564 J	<u>17,900 J</u>	550 J	937 J	624 J	<u>8,150 J</u>	<u>7,880 J</u>
Lead	8.49	270	800	400	1.3	4.2	1.5	1.2	1.6	9.6	2.8	1.8	2.6	6	7
Magnesium	363	--	--	--	1,100 U	740 U	930 U	1,100 U	810 U	1,200 J	1,000 U	1,000 U	1,100 U	970 U	960 U
Manganese	9.25	65	2,300	180	3.4	5.5	4.3	4.1	12.8	19.9	10.2	6.6	9.2	22.5	29
Mercury	0.071	1	31	2.3	0.14 U	0.04 J	0.02 J	0.16 U	0.17 U	0.22 U	0.15 U	0.13 U	0.02 J	0.13 U	0.17 U
Nickel	2.27	130	2,000	150	8.6 U	5.9 U	0.42 J	0.35 J	6.4 U	4 J	1.4 J	0.61 J	8.7 U	7.8 U	7.7 U
Potassium	361	--	--	--	82.7 J	184 J	930 U	1,100 U	58.8 J	1,610 J	1,000 U	1,000 U	85.4 J	676 J	1,120 J
Selenium	0.505	2.1	510	39	1.1 U	0.36 J	0.93 U	1.1 U	0.06 J	0.55 J	1 U	1 U	0.14 J	0.22 J	0.37 J
Silver	0.129	3.4	510	39	2.2 U	1.5 U	1.9 U	2.2 U	1.6 U	0.1 J	2 U	2.1 U	2.2 U	1.9 U	1.9 U
Thallium	0.38	--	--	--	0.54 U	0.03 J	0.01 J	0.54 U	0.4 U	0.12 J	0.02 J	0.01 J	0.01 J	0.08 J	0.11 J
Vanadium	17.2	--	520	39	11 U	7.4 U	9.3 U	11 U	8.1 U	<u>46.4</u>	10 U	10 U	11 U	27.6	33.6
Zinc	6.59	1,200	31,000	2,300	4.3 U	3 U	3.7 U	4.4 U	3.2 U	23.6	4.1 U	4.1 U	4.4 U	7.3	10

Notes:

Shading indicates exceedance of two times the mean base background concentration for subsurface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
mg/kg - Milligrams per kilogram
µg/kg - Micrograms per kilogram

TABLE F-3
UXO-02 Subsurface Soil Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background SB	NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	MR02-TW22/IS22	MR02-TW23/IS23	MR02-TW24/IS24	MR02-TW25/IS25	MR02-TW26/IS26	MR02-TW27/IS27	MR02-TW28/IS28	MR02-TW29/IS29	MR02-TW30/IS30
Sample ID	2X Mean				MR02-IS22-2-3-10A	MR02-IS23-1-2-10A	MR02-IS24-4-5-10A	MR02-IS25-4-5-10A	MR02-IS26-1-2-10A	MR02-IS27-2-3-10A	MR02-IS28-2-3-10A	MR02-IS29-4-5-10A	MR02-IS30-3-4-10A
Sample Date					03/22/10	03/26/10	03/26/10	03/26/10	03/26/10	03/25/10	03/25/10	03/25/10	03/25/10
Chemical Name													
Semivolatile Organic Compounds (µg/kg)													
No Detections					NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (µg/kg)													
No Detections					NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (mg/kg)													
Aluminum	10,369	--	99,000	7,700	1,310	39.3	4,740	11,700	380	1,970	478	941	3,780
Antimony	0.36	--	41	3.1	2.1 UJ	2 U	1.7 U	2.2 U	2.2 U	2.2 UJ	2 UJ	0.1 J	1.6 UJ
Arsenic	2.12	5.8	1.6	0.39	0.52 U	0.49 U	0.61	1.7	0.18 J	0.55 U	0.5 U	0.44 U	0.41 J
Barium	16.6	580	19,000	1,500	2.6 J	39 U	35 U	43 U	44 U	2.3 J	1.4 J	36 U	8.9 J
Cadmium	0.023	3	80	7	0.73 U	0.69 U	0.61 U	0.75 U	0.77 U	0.78 U	0.69 U	0.62 U	0.57 U
Chromium	14.5	3.8	5.6	0.29	2.5	2 U	4	12.3	2.2 U	2.4	2 U	1.8 U	2.3
Cobalt	0.822	--	30	2.3	10 U	9.8 U	0.15 J	0.52 J	11 U	11 U	9.9 U	8.9 U	0.1 J
Copper	2.56	700	4,100	310	5.2 U	4.6 U	4.3 U	5.6 U	3.4 U	5.5 U	5 U	4.4 U	4.1 U
Iron	5,439	150	72,000	5,500	263 J	51.7	966	5,550	185	1,430 J	154 J	371 J	1,620 J
Lead	8.49	270	800	400	2.5	0.3 J	2.2	4.4	0.72	1.6	0.8	1.1	5.3
Magnesium	363	--	--	--	1,000 U	920 U	860 U	1,100 U	690 U	1,100 U	990 U	890 U	820 U
Manganese	9.25	65	2,300	180	8.6	2.8 U	3	8.5	2.7	2.4 J	4.8	6.2	9.3
Mercury	0.071	1	31	2.3	0.02 J	0.18 U	0.18 U	0.16 U	0.19 U	0.01 J	0.17 U	0.18 U	0.02 J
Nickel	2.27	130	2,000	150	0.3 J	7.9 U	1.5 J	2.3 J	8.8 U	0.54 J	0.11 J	0.32 J	6.5 U
Potassium	361	--	--	--	1,000 U	980 U	870 U	1,100 U	1,100 U	1,100 U	990 U	890 U	86.2 J
Selenium	0.505	2.1	510	39	0.09 J	0.98 U	0.12 J	0.25 J	0.12 J	0.05 J	0.99 U	0.89 U	0.21 J
Silver	0.129	3.4	510	39	2.1 U	2 U	0.04 J	0.07 J	2.2 U	2.2 U	2 U	1.8 U	1.6 U
Thallium	0.38	--	--	--	0.52 U	0.49 U	0.02 J	0.09 J	0.55 U	0.01 J	0.5 U	0.44 U	0.05 J
Vanadium	17.2	--	520	39	10 U	0.21 J	6.4 J	17.3	0.57 J	11 U	9.9 U	8.9 U	8.2 U
Zinc	6.59	1,200	31,000	2,300	4.2 U	3.9 U	3.5 U	4.3 U	4.4 U	4.4 U	4 U	3.6 U	3.7

Notes:

Shading indicates exceedance of two times the mean base background concentration for subsurface soil

Bold box indicates exceedance of NC SSLs

Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
mg/kg - Milligrams per kilogram
µg/kg - Micrograms per kilogram

TABLE F-4
IR69 Subsurface Soil Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background SB 2X Mean	CLEAN NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	MR02-IR69-IS01		MR02-IR69-IS02	MR02-IR69-IS03
Sample ID					MR02-IR69-IS01-5-6-10A	MR02-IR69-IS01D-5-6-10A	MR02-IR69-IS02-05-07-10A	MR02-IR69-IS03-7_5-9_5-10A
Sample Date					03/11/10	03/11/10	03/06/10	03/08/10
Chemical Name								
Semivolatile Organic Compounds (µg/kg)								
No Detections					NA	NA	NA	NA
Explosives (µg/kg)								
No Detections					NA	NA	NA	NA
Total Metals (mg/kg)								
Aluminum	10,369	--	99,000	7,700	4,530	3,510	1,070	6,340
Arsenic	2.12	5.8	1.6	0.39	<u>0.73</u>	<u>0.55</u>	0.21 J	<u>0.91</u>
Barium	16.6	580	19,000	1,500	6.5 J	5.5 J	3.4 J	5.9 J
Chromium	14.5	3.8	5.6	0.29	6.3	6.6	2 U	6.5
Iron	5,439	150	72,000	5,500	2,120	1,960	645	2,470
Lead	8.49	270	800	400	2.4	2.2	2	2.7
Manganese	9.25	65	2,300	180	12	12.9	10.5	5.6
Potassium	361	--	--	--	128 J	90.2 J	38.5 J	207 J
Thallium	0.38	--	--	--	0.03 J	0.02 J	0.5 U	0.03 J
Vanadium	17.2	--	520	39	6.9 J	5.3 J	1.5 J	9.6 J
Zinc	6.59	1,200	31,000	2,300	4.1 U	4.2 U	1.2 J	16.8

Notes:

- Shading indicates exceedance of two times the mean base background concentration for subsurface soil
- Bold text indicates exceedance of NC SSLs
- Bold text indicates exceedance of Adjusted Industrial Soil RSLs**
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
mg/kg - Milligrams per kilogram
µg/kg - Micrograms per kilogram

TABLE F-5
UXO-02 Groundwater Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background GW 2X Mean	NC2LGW (January, 2010)*	Adjusted Tap Water RSLs (May, 2010)	MR02-TW01/IS01 MR02-GW01-10A 03/30/10	MR02-TW02/IS02 MR02-GW02-10A 03/30/10	MR02-TW03/IS03 MR02-GW03-10A 03/30/10	MR02-TW04/IS04 MR02-GW04-10A 03/31/10	MR02-TW06/IS06 MR02-GW06-10A 03/31/10	MR02-TW08/IS08 MR02-GW08-10A 04/01/10	MR02-TW09/IS09 MR02-GW09-10A 03/30/10	MR02-TW10/IS10 MR02-GW10-10A 03/31/10	MR02-TW11/IS11 MR02-GW11-10A 03/30/10	MR02-TW12/IS12 MR02-GW12-10A 03/31/10	MR02-TW13/IS13 MR02-GW13-10A 03/30/10	MR02-TW14/IS14 MR02-GW14-10A 03/30/10	MR02-TW15/IS15 MR02-GW15-10A 03/29/10MR02-GW15D-10A 03/29/10		MR02-TW16/IS16 MR02-GW16-10A 04/01/10
Sample ID																		
Sample Date																		
Chemical Name																		
Semivolatile Organic Compounds (µg/l)																		
No Detections																		
Explosives (µg/l)																		
No Detections																		
Total Metals (µg/l)																		
Aluminum	1,886	--	3,700	343 J	64.6 J	424 J	200 U	42,000	28,400	1,420 J	4,150	1,080 J	14,100	7,270 J	739 J	203 J	343 J	8,190
Antimony	3.28	6	1.5	10 U	10 U	10 U	10 U	10 U	7 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Arsenic	5.77	10	0.045	10 U	10 U	10 U	10 U	5.5 J	6.2 J	10 U	10 U	10 U	9.3 J	10 U	10 U	10 U	10 U	10 U
Barium	86.2	700	730	18.9 J	43.6 J	27.8 J	15.5 J	214	200 U	138 J	19.8 J	29.6 J	105 J	40.4 J	31.7 J	29.8 J	30.5 J	200 U
Calcium	69,078	--	--	23,600 J	11,000 J	17,600 J	11,100	5,000 U	5,000 U	6,110 J	5,000 U	7,630 J	10,400	5,000 UJ	5,000 UJ	5,000 UJ	5,000 UJ	11,100
Chromium	3.13	10	0.043	10 U	10 U	10 U	10 U	46	29.5	10 U	10.6	10 U	23.3	10 U	10 U	10 U	10 U	18.6
Cobalt	3.4	--	1.1	50 U	50 U	50 U	50 U	3.2 J	2 J	50 U	50 U	50 U	10 J	50 U	50 U	50 U	50 U	1.5 J
Copper	2.76	1,000	150	25 U	25 U	25 U	25 U	48.4	27.7	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	26.2
Iron	5,999	300	2,600	440 J	113 J	484 J	100 U	14,700	14,900	1,540 J	828	581 J	20,700	1,900 J	308 J	358 J	364 J	8,400
Lead	2.8	15	15	3 U	0.81 J	1.1 J	1.1 J	24.1	19.2	3 U	2.6 J	3 U	9.3	1.2 J	3 U	1.3 J	3 U	6
Magnesium	6,363	--	--	5,000 UJ	5,000 UJ	5,000 UJ	5,000 U	5,000 U	5,000 U	8,410 J	5,000 U	5,000 UJ	7,650	5,000 UJ	5,000 UJ	5,000 UJ	5,000 UJ	5,000 U
Manganese	214	50	88	35.4	53	64.6	18.9	65.1	39.5	131	15 U	15 U	245	29.9	20	66.2	71.8	131
Mercury	0.1	1	1.1	0.2 U	0.2 U	0.2 U	0.2 U	0.08 J	0.04 J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	7.97	100	73	40 U	4.2 J	1.4 J	1.7 J	16.6 J	11.5 J	5.8 J	5.9 J	16.2 J	22.7 J	8.9 J	1.3 J	5.4 J	5 J	9.6 J
Potassium	3,277	--	--	738 J	1,150 J	1,580 J	1,290 J	3,750 J	9,040	2,370 J	539 J	355 J	3,230 J	408 J	536 J	386 J	441 J	1,550 J
Selenium	3.14	20	18	5 U	5 U	5 U	5 U	5 U	1.3 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.56 J
Sodium	22,508	--	--	37,800	39,300	29,200	11,100	5,300	5,000 U	75,000	10,900	21,800	38,000	16,000	5,000 U	5,610	5,500	21,400
Thallium	3.78	2	--	2 U	2 U	2 U	2 U	0.41 J	0.18 J	0.06 J	2 U	2 U	0.18 J	0.06 J	2 U	2 U	2 U	0.07 J
Vanadium	4.72	--	18	0.5 J	50 U	0.55 J	50 U	49.4 J	37.5 J	1.5 J	4.5 J	1.8 J	25.8 J	2.2 J	50 U	50 U	50 U	12.3 J
Zinc	42.1	1,000	1,100	20 U	20 U	20 U	20 U	189	109	20 U	27.7	41.2	136	57.3	20 U	138	142	424
Dissolved Metals (µg/l)																		
Aluminum, Dissolved	1,886	--	3,700	NA	NA	NA	NA	246	927	NA	1,960	NA	1,370	NA	NA	NA	NA	19 J
Antimony, Dissolved	3.28	6	1.5	NA	NA	NA	NA	10 U	10 U	NA	10 U	NA	10 U	NA	NA	NA	NA	10 U
Arsenic, Dissolved	5.77	10	0.045	NA	NA	NA	NA	10 U	10 U	NA	10 U	NA	4 J	NA	NA	NA	NA	10 U
Barium, Dissolved	86.2	700	730	NA	NA	NA	NA	37.8 J	200 U	NA	16.5 J	NA	83.9 J	NA	NA	NA	NA	200 U
Calcium, Dissolved	69,078	--	--	NA	NA	NA	NA	5,000 U	5,000 U	NA	5,000 U	NA	10,600	NA	NA	NA	NA	10,500
Cobalt, Dissolved	3.4	--	1.1	NA	NA	NA	NA	50 U	50 U	NA	50 U	NA	8.6 J	NA	NA	NA	NA	0.86 J
Iron, Dissolved	5,999	300	2,600	NA	NA	NA	NA	100 U	306	NA	415	NA	11,400	NA	NA	NA	NA	2,710
Lead, Dissolved	2.8	15	15	NA	NA	NA	NA	3 U	0.8 J	NA	3 U	NA	0.85 J	NA	NA	NA	NA	3 U
Magnesium, Dissolved	6,363	--	--	NA	NA	NA	NA	5,000 U	5,000 U	NA	5,000 U	NA	7,190	NA	NA	NA	NA	5,000 U
Manganese, Dissolved	214	50	88	NA	NA	NA	NA	15 U	15 U	NA	15 U	NA	209	NA	NA	NA	NA	117
Nickel, Dissolved	7.97	100	73	NA	NA	NA	NA	1.1 J	1.3 J	NA	8 J	NA	19.6 J	NA	NA	NA	NA	5.7 J
Potassium, Dissolved	3,277	--	--	NA	NA	NA	NA	1,360 J	7,390	NA	500 J	NA	2,260 J	NA	NA	NA	NA	902 J
Selenium, Dissolved	3.14	20	18	NA	NA	NA	NA	5 U	5 U	NA	0.72 J	NA	0.89 J	NA	NA	NA	NA	5 U
Sodium, Dissolved	22,508	--	--	NA	NA	NA	NA	5,560	5,000 U	NA	11,300	NA	39,400	NA	NA	NA	NA	22,300
Thallium, Dissolved	3.78	2	--	NA	NA	NA	NA	2 U	2 U	NA	2 U	NA	0.06 J	NA	NA	NA	NA	2 U
Vanadium, Dissolved	4.72	--	18	NA	NA	NA	NA	50 U	0.95 J	NA	2.8 J	NA	6.4 J	NA	NA	NA	NA	50 U
Zinc, Dissolved	42.1	1,000	1,100	NA	NA	NA	NA	72.7	23.9	NA	23.6	NA	114	NA	NA	NA	NA	126

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box Indicates exceedance of NC2LGW

Bold text indicates exceedance of Adjusted Tap Water RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more conservative.

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

µg/l - Micrograms per liter

TABLE F-5
UXO-02 Groundwater Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background GW 2X Mean	NC2LGW (January, 2010)*	Adjusted Tap Water RSLs (May, 2010)	MR02-TW17/IS17 MR02-GW17-10A 03/30/10	MR02-TW18/IS18 MR02-GW18-10A 03/31/10	MR02-TW19/IS19 MR02-GW19-10A 03/29/10	MR02-TW20/IS20 MR02-GW20-10A 03/29/10	MR02-TW21/IS21 MR02-GW21D-10A 03/29/10	MR02-TW22/IS22 MR02-GW22-10A 03/29/10	MR02-TW23/IS23 MR02-GW23-10A 03/30/10	MR02-TW24/IS24 MR02-GW24-10A 03/31/10	MR02-TW25/IS25 MR02-GW25-10A 03/31/10	MR02-TW26/IS26 MR02-GW26-10A 03/30/10	MR02-TW27/IS27 MR02-GW27-10A 03/31/10	MR02-TW28/IS28 MR02-GW28-10A 03/31/10	MR02-TW29/IS29 MR02-GW29-10A 03/31/10	MR02-TW30/IS30 MR02-GW30-10A 03/31/10		
Sample ID																			
Sample Date																			
Chemical Name																			
Semivolatile Organic Compounds (µg/l)																			
No Detections																			
Explosives (µg/l)																			
No Detections																			
Total Metals (µg/l)																			
Aluminum	1,886	--	3,700	55,400 J	4,720	621 J	2,690 J	1,820 J	904 J	530 J	6,220 J	550 J	4,720	757	6,890 J	1,030	1,830	2,590	3,970
Antimony	3.28	6	1.5	10 U	2 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Arsenic	5.77	10	0.045	5.3 J	10 U	10 U	10 U	10 U	10 U	10 U	2 J	10 U	10 U	10 U	10 U	10 U	2.9 J	10 U	10 U
Barium	86.2	700	730	139 J	44 J	21.9 J	25.9 J	25.6 J	26.5 J	25.8 J	32.8 J	15.5 J	64 J	53.6 J	30.7 J	25.9 J	8.5 J	43.5 J	59.5 J
Calcium	69,078	--	--	7,120 J	5,000 U	5,000 UJ	5,000 UJ	5,000 UJ	5,000 UJ	5,000 UJ	5,000 UJ	5,000 UJ	5,000 U	5,000 U	5,000 UJ	5,000 U	5,000 U	9,720	8,510
Chromium	3.13	10	0.043	56.8	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	14.6
Cobalt	3.4	--	1.1	50 U	50 U	50 U	50 U	50 U	50 U	50 U	1.5 J	1.2 J	50 U	50 U	50 U	50 U	0.87 J	1.5 J	1.5 J
Copper	2.76	1,000	150	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Iron	5,999	300	2,600	14,000 J	1,580	259 J	712 J	563 J	556 J	426 J	2,120 J	889 J	4,900	1,660	3,200 J	641	2,170	5,110	4,410
Lead	2.8	15	15	22.5	6.2	3 U	3.6	2.4 J	3 U	3 U	7.3	3 U	3.5	3 U	3.2	1.2 J	3 U	3 J	3.2
Magnesium	6,363	--	--	5,000 UJ	5,000 U	5,000 UJ	5,000 UJ	5,000 UJ	5,000 UJ	5,000 UJ	5,000 UJ	5,000 UJ	5,000 U	5,000 U	5,000 UJ	5,000 U	5,000 U	5,000 U	5,000 U
Manganese	214	50	88	63	132	37.8	47.2	44.3	15 U	15 U	24.9	15 U	109	79.7	26.1	22.8	17.1	204	62
Mercury	0.1	1	1.1	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	7.97	100	73	16.3 J	2 J	3.4 J	1.5 J	1.8 J	0.9 J	1 J	4.4 J	1.4 J	16.7 J	24.5 J	4.8 J	2.1 J	0.46 J	6.6 J	3.7 J
Potassium	3,277	--	--	3,560 J	1,150 J	496 J	759 J	736 J	964 J	934 J	755 J	408 J	1,420 J	802 J	558 J	488 J	280 J	1,550 J	2,920 J
Selenium	3.14	20	18	0.82 J	0.77 J	5 U	0.57 J	5 U	5 U	5 U	5 U	5 U	1.3 J	0.64 J	5 U	5 U	5 U	5 U	5 U
Sodium	22,508	--	--	9,150	13,600	5,000 U	10,500	10,000	8,430	8,320	12,400	5,710	10,700	12,400	14,700	7,160	5,780	18,000	30,600
Thallium	3.78	2	--	0.3 J	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.11 J	2 U	2 U	2 U	2 U	2 U	0.07 J
Vanadium	4.72	--	18	54.5	2.6 J	50 U	0.64 J	50 U	1 J	0.57 J	7.6 J	0.69 J	8.2 J	0.7 J	11.5 J	0.83 J	2.5 J	4.5 J	11.5 J
Zinc	42.1	1,000	1,100	31.6	20 U	20 U	20 U	20 U	20 U	20 U	20 U	32.9	174	315	20 U	20 U	20 U	321	140
Dissolved Metals (µg/l)																			
Aluminum, Dissolved	1,886	--	3,700	145 J	73.8 J	NA	NA	NA	NA	NA	1,280 J	NA	309	114 J	1,290 J	NA	NA	124 J	30.3 J
Antimony, Dissolved	3.28	6	1.5	10 U	10 U	NA	NA	NA	NA	NA	10 U	NA	10 U	10 U	10 U	NA	NA	1.9 J	10 U
Arsenic, Dissolved	5.77	10	0.045	10 U	10 U	NA	NA	NA	NA	NA	10 U	NA	10 U	10 U	10 U	NA	NA	10 U	10 U
Barium, Dissolved	86.2	700	730	23.7 J	24.2 J	NA	NA	NA	NA	NA	15.5 J	NA	55.7 J	59 J	17.8 J	NA	NA	27.1 J	56.2 J
Calcium, Dissolved	69,078	--	--	5,000 UJ	5,000 U	NA	NA	NA	NA	NA	5,000 UJ	NA	5,000 U	5,000 U	5,000 UJ	NA	NA	5,000 U	8,580
Cobalt, Dissolved	3.4	--	1.1	50 U	50 U	NA	NA	NA	NA	NA	50 U	NA	0.85 J	1.1 J	50 U	NA	NA	50 U	0.9 J
Iron, Dissolved	5,999	300	2,600	34.2 J	100 U	NA	NA	NA	NA	NA	722 J	NA	1,890	1,040	1,890 J	NA	NA	2,010	182
Lead, Dissolved	2.8	15	15	3 U	3 U	NA	NA	NA	NA	NA	3.4	NA	1 J	3 U	3 U	NA	NA	3 U	3 U
Magnesium, Dissolved	6,363	--	--	5,000 UJ	5,000 U	NA	NA	NA	NA	NA	5,000 UJ	NA	5,000 U	5,000 U	5,000 UJ	NA	NA	5,000 U	5,000 U
Manganese, Dissolved	214	50	88	15.7	65.5	NA	NA	NA	NA	NA	15 U	NA	83.4	82.3	22.2	NA	NA	103	56.2
Nickel, Dissolved	7.97	100	73	1.7 J	1.1 J	NA	NA	NA	NA	NA	3.5 J	NA	15.3 J	26.8 J	4 J	NA	NA	2.8 J	4.7 J
Potassium, Dissolved	3,277	--	--	1,100 J	931 J	NA	NA	NA	NA	NA	675 J	NA	889 J	745 J	428 J	NA	NA	712 J	2,480 J
Selenium, Dissolved	3.14	20	18	5 U	0.79 J	NA	NA	NA	NA	NA	0.64 J	NA	5 U	1 J	5 J	NA	NA	0.78 J	0.59 J
Sodium, Dissolved	22,508	--	--	7,120	13,200	NA	NA	NA	NA	NA	12,800	NA	10,900	12,300	14,000	NA	NA	10,100	33,000
Thallium, Dissolved	3.78	2	--	2 U	2 U	NA	NA	NA	NA	NA	2 U	NA	2 U	2 U	2 U	NA	NA	2 U	2 U
Vanadium, Dissolved	4.72	--	18	50 U	50 U	NA	NA	NA	NA	NA	50 U	NA	50 U	50 U	5.6 J	NA	NA	50 U	50 U
Zinc, Dissolved	42.1	1,000	1,100	20 U	20 U	NA	NA	NA	NA	NA	20 U	NA	160	332	20 U	NA	NA	48.4	22.9

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box indicates exceedance of NC2LGW

Bold text indicates exceedance of Adjusted Tap Water RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
* - The MCL-Groundwater value is reported in place of the NC2LGW where the MCL value is more conservative.
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
µg/l - Micrograms per liter

TABLE F-6
IR69 Groundwater Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Camp Lejeune Background GW 2X Mean	NC2LGW (January, 2010)	Adjusted Tap Water RSLs	MR02-IR69-MW05		MR02-IR69-MW09	MR02-IR69-MW11	MR02-IR69-MW12	MR02-IR69-MW13	MR02-IR69-MW14	MR02-IR69-MW15
Sample ID				MR02-IR69-GW05-10A	MR02-IR69-GW05D-10A	MR02-IR69-GW09-10A	MR02-IR69-GW11-10A	MR02-IR69-GW12-10A	MR02-IR69-GW13-10A	MR02-IR69-GW14-10A	MR02-IR69-GW15-10A
Sample Date				03/08/10	03/08/10	03/01/10	03/01/10	02/27/10	03/01/10	02/28/10	03/07/10
Chemical Name											
Semivolatile Organic Compounds (µg/l)											
No Detections				NA	NA	NA	NA	NA	NA	NA	NA
Explosives (µg/l)											
No Detections				NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (µg/l)											
Aluminum	1,886	--	3,700	200 U	200 U	1,280 J	835 J	458 J	1,010 J	294 J	723
Arsenic	5.77	10	0.045	10 U	10 U	10 U	10 U	2.4 J	10 U	10 U	5.6 J
Barium	86.2	700	730	200 U	200 U	200 U	200 U	200 U	200 U	200 U	67.5 J
Calcium	69,078	--	--	5,000 U	5,000 U	5,190	5,000 U	5,000 U	5,000 U	5,000 U	63,300
Chromium	3.13	10	0.043	10 U	10 U	1.9 J	0.62 J	0.65 J	0.73 J	10 U	1.7 J
Cobalt	3.4	--	1.1	50 U	50 U	2 J	0.83 J	0.47 J	0.29 J	50 U	50 U
Copper	2.76	1,000	150	25 U	25 U	5.7 J	25 U	25 U	25 U	25 U	25 U
Iron	5,999	300	2,600	86.6 J	125	1,360 J	220 J	5,460 J	1,380 J	237 J	30,800
Lead	2.8	15	15	3 U	3 U	1.8 J	1.7 J	3 U	3 U	3 U	3 U
Manganese	214	50	88	38.3 J	24.6 J	38.8	5 J	19.2	9.3 J	15	802
Potassium	3,277	--	--	5,000 U	5,000 U	846 J	414 J	478 J	5,000 U	202 J	5,000 U
Sodium	22,508	--	--	5,000 U	5,000 U	12,800	10,200	8,760	6,360	6,880	24,100
Vanadium	4.72	--	18	50 U	50 U	1.6 J	50 U	0.97 J	1.8 J	0.38 J	1 J
Zinc	42.1	1,000	1,100	20 U	20 U	20 U	20 U	63.5	20 U	20 U	20 U
Dissolved Metals (µg/l)											
Aluminum, Dissolved	1,886	--	3,700	74.2 J	47.1 J	25.8 J	816	283	468	146 J	368
Calcium, Dissolved	69,078	--	--	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	60,400
Chromium, Dissolved	3.13	10	0.043	10 U	10 U	10 U	0.64 J	0.71 J	0.74 J	0.44 J	1.4 J
Cobalt, Dissolved	3.4	--	1.1	50 U	50 U	1.6 J	0.55 J	50 U	50 U	50 U	50 U
Iron, Dissolved	5,999	300	2,600	38.4 J	100 U	100 U	109	5,090	1,150	100 U	27,800
Lead, Dissolved	2.8	15	15	3 U	3 U	3 U	1.2 J	3 U	3 U	3 U	1.2 J
Manganese, Dissolved	214	50	88	35.8 J	23.3 J	35.5	4.4 J	20.6	9.6 J	15.1	763
Potassium, Dissolved	3,277	--	--	5,000 U	5,000 U	768 J	394 J	496 J	5,000 U	149 J	5,000 U
Sodium, Dissolved	22,508	--	--	5,000 U	5,000 U	13,200	10,300	9,050	6,380	6,970	23,000
Vanadium, Dissolved	4.72	--	18	50 U	50 U	50 U	50 U	0.83 J	1.2 J	50 U	0.42 J
Zinc, Dissolved	42.1	1,000	1,100	7.3 J	4.9 J	20 U	20 U	87.5	20 U	20 U	7.7 J

Notes:

Shading indicates exceedance of two times the mean base background concentration for Groundwater

Bold box indicates exceedance of NC2LGW

Bold text indicates exceedance of Adjusted Tap Water RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
µg/l - Micrograms per liter

TABLE F-7
UXO-02 Sediment Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	MR02-SD01/SW01	MR02-SD02/SW02	MR02-SD03/SW03	MR02-SD04/SW04	MR02-SD05/SW05		MR02-SD06/SW06	MR02-SD07/SW07	MR02-SD08/SW08	MR02-SD09/SW09	MR02-SD10/SW10
Sample ID			MR02-SD01-10A	MR02-SD02-10A	MR02-SD03-10A	MR02-SD04-10A	MR02-SD05-10A	MR02-SD05D-10A	MR02-SD06-10A	MR02-SD07-10A	MR02-SD08-10A	MR02-SD09-10A	MR02-SD10-10A
Sample Date			02/09/10	02/09/10	02/08/10	02/09/10	02/08/10	02/08/10	02/09/10	02/08/10	02/09/10	02/09/10	02/09/10
Chemical Name													
Semivolatile Organic Compounds (µg/kg)													
No Detections			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (µg/kg)													
Perchlorate	72,000	5,500	8.2	12	13	10	14	16	19	2.8	7.3	10	7
Total Metals (mg/kg)													
Aluminum	99,000	7,700	<u>31,400</u>	<u>19,100</u>	<u>24,300</u>	<u>8,730</u>	<u>19,800</u>	<u>24,200</u>	<u>9,490</u>	2,400	<u>11,000</u>	<u>14,400</u>	4,630
Arsenic	1.6	0.39	<u>5.8</u>	<u>3.2</u>	<u>4.2</u>	<u>1.2</u> J	<u>3.5</u>	<u>3.3</u>	<u>1.2</u> J	<u>0.49</u> J	<u>2.5</u>	<u>2.8</u>	<u>1</u> J
Beryllium	200	16	0.59 J	0.36 J	0.56 J	0.47 J	0.44 J	0.52 J	1.1 J	0.03 J	0.23 J	0.36 J	0.07 J
Calcium	--	--	3,400 U	5,400 U	7,220	5,000 U	6,130	6,470	6,970	3,090	2,800 U	3,400 U	3,400 U
Chromium	5.6	0.29	<u>39.7</u>	<u>23.4</u>	<u>27.3</u>	10 U	<u>22.1</u>	<u>27.4</u>	14 U	<u>3.4</u>	<u>14.7</u>	<u>17</u>	6.9 U
Cobalt	30	2.3	34 U	1.5 J	2 J	0.88 J	41 U	54 U	69 U	0.36 J	1 J	1.2 J	0.46 J
Iron	72,000	5,500	<u>16,800</u>	<u>11,100</u>	<u>10,900</u>	2,180	<u>11,200</u>	<u>13,100</u>	3,880	1,220	<u>6,320</u>	<u>6,960</u>	1,850
Lead	800	400	14.4	17	19.4	24.5	17.2	19.8	14.9	3.5	8.9	10.2	13.7
Magnesium	--	--	4,210	5,980	7,930	5,000 U	6,050	6,740	6,900 U	1,000 U	2,800 U	3,400 U	3,400 U
Manganese	2,300	180	38 J	33.7 J	49.7 J	16.3 J	71.4 J	80.2 J	30 J	16.8 J	27.8 J	19.2 J	13.6 J
Sodium	--	--	9,830	13,200	18,000	5,000 U	16,600	18,600	6,900 U	1,000 U	2,800 U	3,480	3,400 U
Vanadium	520	39	<u>47.7</u>	32.5 J	34 J	10 J	31.5 J	36.9 J	10.2 J	3.7 J	17.9 J	20.9 J	7.4 J
Zinc	31,000	2,300	37	24	37.7	31.2	43.3	48.9	33.4	25.8	15	17.5	14 U

Notes:
Bold text indicates exceedance of Adjusted Industrial Soil RSLs
Underline indicates exceedance of Adjusted Residential Soil RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
mg/kg - Milligrams per kilogram
µg/kg - Micrograms per kilogram

TABLE F-8
UXO-02 Surface Water Analytical Results
Site UXO-02, Unnamed Explosive Contaminated Range
PA/SI Report
MCB CamLej
North Carolina

Station ID	NC2B-SW-Human Health & Water Supply 1	NRWQC-Human Health - Organisms & Water + Organisms 2	Adjusted Tap Water RSLs (May, 2010)	MR02-SD01/SW01	MR02-SD02/SW02	MR02-SD03/SW03	MR02-SD04/SW04	MR02-SD05/SW05		MR02-SD06/SW06	MR02-SD07/SW07	MR02-SD08/SW08	MR02-SD09/SW09	MR02-SD10/SW10
Sample ID				MR02-SW01-10A	MR02-SW02-10A	MR02-SW03-10A	MR02-SW04-10A	MR02-SW05-10A	MR02-SW05D-10A	MR02-SW06-10A	MR02-SW07-10A	MR02-SW08-10A	MR02-SW09-10A	MR02-SW10-10A
Sample Date				02/09/10	02/09/10	02/08/10	02/09/10	02/08/10	02/08/10	02/09/10	02/08/10	02/09/10	02/09/10	02/09/10
Chemical Name														
Semivolatile Organic Compounds (µg/l)														
No Detections				NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (µg/l)														
No Detections				NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Metals (µg/l)														
Aluminum	--	--	3,700	683	803	368	255	1,960 J	1,330 J	200 U	449	200 U	674	216
Arsenic	10	0.018	0.045	1.6 J	1.3 J	1.6 J	10 U	1.3 J	3.1 J	10 U	10 U	1.5 J	10 U	10 U
Barium	1,000	1,000	730	9.8 J	200 U	17.1 J	20.7 J	18.7 J	17.5 J	18.7 J	24.8 J	15.6 J	12.2 J	6.9 J
Calcium	--	--	--	25,600	34,700	6,970	5,000 U	34,700	35,000	5,000 U	10,200	8,200	7,080	5,000 U
Chromium	--	100	0.043	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	0.47 J	10 U
Cobalt	--	--	1.1	50 U	0.38 J	50 U	0.42 J	0.33 J	0.37 J	50 U	0.67 J	50 U	0.41 J	50 U
Iron	--	300	2,600	464	800	252	125	1,080	926	100 U	979	100 U	2,140	429
Lead	--	--	15	3 U	3 U	3 U	3 U	3 U	3 U	1.3 J	3 U	3 U	3 U	1.1 J
Magnesium	--	--	--	67,600	89,200	13,500	10,300	48,000	49,500	5,000 U	5,000 U	9,030	12,800	5,000 U
Manganese	200	50	88	6 J	8.6 J	11.7 J	7.3 J	55.4	53.4	6.2 J	52.5	4.6 J	20.6	5.8 J
Nickel	25	610	73	40 U	40 U	0.58 J	40 U	40 U	40 U	40 U	1.4 J	40 U	40 U	40 U
Potassium	--	--	--	22,700	33,200	4,820 J	3,800 J	16,900	17,300	1,140 J	1,030 J	2,920 J	5,000 U	1,050 J
Selenium	--	50	18	1.4 J	2.9 J	5 U	5 U	1.2 J	1 J	5 U	5 U	5 U	5 U	5 U
Sodium	--	--	--	532,000	689,000	124,000	100,000	409,000	411,000	20,500	9,170	77,800	130,000	24,500
Vanadium	--	--	18	1.3 J	50 U	0.78 J	0.45 J	3 J	2.1 J	50 U	0.68 J	0.44 J	50 U	0.64 J
Zinc	--	7,400	1,100	2.3 J	20 U	2.6 J	13.1 J	6.7 J	6.3 J	3.8 J	39.9	8.5 J	3.6 J	8.5 J
Dissolved Metals (µg/l)														
Aluminum, Dissolved	--	--	3,700	200 U	200 U	200 U	268	200 U	200 U	200 U	309	200 U	511	200 U
Arsenic, Dissolved	10	0.018	0.045	10 U	3.2 J	10 U	10 U	1.7 J	1.3 J	10 U	10 U	10 U	10 U	2.2 J
Barium, Dissolved	1,000	1,000	730	200 U	200 U	16.2 J	23.2 J	16.6 J	16.1 J	17.9 J	23.7 J	11.8 J	11.5 J	6.7 J
Calcium, Dissolved	--	--	--	24,000	32,800	7,740	5,270	33,200	33,100	5,000 U	10,000	8,260	6,850	5,000 U
Cobalt, Dissolved	--	--	1.1	50 U	50 U	50 U	0.43 J	0.32 J	50 U	50 U	0.72 J	50 U	0.43 J	50 U
Copper, Dissolved	--	1,300	150	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	3.2 J	25 U
Iron, Dissolved	--	300	2,600	202	354	101	130	255	258	100 U	706	100 U	1,420	241
Lead, Dissolved	--	--	15	3 U	3 U	3 U	5.2	3 U	3 U	2 J	3 U	3 U	3 U	1.4 J
Magnesium, Dissolved	--	--	--	63,300	84,700	16,100	11,300	45,900	46,600	5,000 U	5,000 U	8,980	12,100	5,000 U
Manganese, Dissolved	200	50	88	5.3 J	6.9 J	13.7 J	9.1 J	52.3	51.3	6.1 J	54.4	4.6 J	20.6	7.1 J
Nickel, Dissolved	25	610	73	40 U	40 U	40 U	40 U	40 U	40 U	40 U	1.3 J	40 U	40 U	40 U
Potassium, Dissolved	--	--	--	21,300	32,100	5,310	4,250 J	16,200	16,500	1,000 J	978 J	3,040 J	5,000 U	913 J
Selenium, Dissolved	--	50	18	1.5 J	1.9 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.9 J	5 U
Sodium, Dissolved	--	--	--	507,000	670,000	142,000	110,000	394,000	395,000	19,800	9,190	77,500	125,000	24,800
Vanadium, Dissolved	--	--	18	50 U	50 U	50 U	0.46 J	1 J	0.78 J	0.44 J	0.51 J	0.37 J	50 U	50 U
Zinc, Dissolved	--	7,400	1,100	20 U	20 U	5.9 J	15.6 J	10.7 J	10.8 J	5.5 J	38.6	16.7 J	13.4 J	11.7 J

Notes:

Bold box indicates exceedance of NC2B-SW-Human Health + Water Supply

Bold text indicates exceedance of NRWQC-Human Health - Water+ Organisms

Underline indicates exceedance of Adjusted Tap Water RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

1 - NC2B-SW-Human Health and NC2B-SW-Water Supply were combined to show the most conservative criteria

2 - NRWQC-Human Health - Water+ Organisms and NRWQC-Human Health Organisms were combined to show the most conservative criteria

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

µg/l - Micrograms per liter

Appendix G

Human Health Risk Screening Tables

TABLE 2.1

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site UXO-02

MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
 Medium: Surface Soil
 Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Deletion or Selection
Surface Soil UXO-02	71-55-6	1,1,1-Trichloroethane	ND	ND	MG/KG	MR02-IR69-SS06-10A	0/4	0.0054 - 0.34	3.4E-01	N/A	6.4E+02 NS	1.2E+00	NCSSL	NO	DLBSL
	79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	5.6E-01 C	1.2E-03	NCSSL	NO	DLBSL
	76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	9.1E+02 NS	9.2E+03	NCSSL	NO	DLBSL
	79-00-5	1,1,2-Trichloroethane	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	1.1E+00 C	N/A	NCSSL	NO	DLBSL
	75-34-3	1,1-Dichloroethane	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	3.3E+00 C	3.0E-02	NCSSL	NO	DLBSL
	75-35-4	1,1-Dichloroethene	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	2.4E+01 N	4.6E-02	NCSSL	NO	DLBSL
	120-82-1	1,2,4-Trichlorobenzene	1.1E-03 J	1.1E-03 J	MG/KG		1/5	0.0047 - 0.34	1.1E-03	N/A	6.2E+00 C**	2.2E+00	NCSSL	NO	BSL
	96-12-8	1,2-Dibromo-3-chloropropane	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	5.4E-03 C	2.5E-04	NCSSL	YES	DLASL
	106-93-4	1,2-Dibromoethane	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	3.4E-02 C	9.7E-05	NCSSL	YES	DLASL
	95-50-1	1,2-Dichlorobenzene	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	1.9E+02 NS	2.4E-01	NCSSL	NO	DLBSL
	107-06-2	1,2-Dichloroethane	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	4.3E-01 C	2.0E-03	NCSSL	NO	DLBSL
	78-87-5	1,2-Dichloropropane	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	8.9E-01 C*	3.3E-03	NCSSL	NO	DLBSL
	541-73-1	1,3-Dichlorobenzene	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	2.4E+00 C	7.6E+00	NCSSL	NO	DLBSL
	106-46-7	1,4-Dichlorobenzene	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	2.4E+00 C	7.0E-02	NCSSL	NO	DLBSL
	78-93-3	2-Butanone	ND	ND	MG/KG		0/4	0.013 - 0.85	8.5E-01	N/A	2.8E+03 N	1.6E+01	NCSSL	NO	DLBSL
	591-78-6	2-Hexanone	ND	ND	MG/KG		0/5	0.012 - 0.85	8.5E-01	N/A	2.1E+01 N	1.2E+00	NCSSL	NO	DLBSL
	108-10-1	4-Methyl-2-pentanone	ND	ND	MG/KG		0/5	0.012 - 0.85	8.5E-01	N/A	5.3E+02 NS	N/A	NCSSL	NO	DLBSL
	67-64-1	Acetone	2.1E-01 J	7.3E-01 J	MG/KG		4/5	0.012 - 0.85	7.3E-01	N/A	6.1E+03 N	2.4E+01	NCSSL	NO	BSL
	71-43-2	Benzene	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	1.1E+00 C*	7.3E-03	NCSSL	NO	DLBSL
	75-27-4	Bromodichloromethane	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	2.7E-01 C	2.9E-03	NCSSL	YES	DLASL
	75-25-2	Bromoform	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	6.1E+01 C*	1.9E-02	NCSSL	NO	DLBSL
	74-83-9	Bromomethane	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	7.3E-01 N	N/A	NCSSL	NO	DLBSL
	75-15-0	Carbon disulfide	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	8.2E+01 NS	3.8E+00	NCSSL	NO	DLBSL
	56-23-5	Carbon tetrachloride	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	6.1E-01 C	2.0E-03	NCSSL	NO	DLBSL
	108-90-7	Chlorobenzene	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	2.9E+01 N	4.5E-01	NCSSL	NO	DLBSL
	75-00-3	Chloroethane	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	1.5E+03 NS	1.6E+01	NCSSL	NO	DLBSL
	67-66-3	Chloroform	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	2.9E-01 C	3.4E-01	NCSSL	YES	DLASL
	74-87-3	Chloromethane	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	1.2E+01 N	1.5E-02	NCSSL	NO	DLBSL
	156-59-2	cis-1,2-Dichloroethene	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	7.8E+01 N	3.6E-01	NCSSL	NO	DLBSL
	10061-01-5	cis-1,3-Dichloropropene	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	1.7E+00 C*	2.3E-03	NCSSL	NO	DLBSL
	110-82-7	Cyclohexane	4.4E-04 J	4.4E-04 J	MG/KG	MR02-IR69-SS04-10A : MR02-IR69-SS05-10A	2/5	0.0047 - 0.34	4.4E-04	N/A	1.2E+02 NS	N/A	NCSSL	NO	BSL
	124-48-1	Dibromochloromethane	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	6.8E-01 C	1.9E-03	NCSSL	NO	DLBSL
	75-71-8	Dichlorodifluoromethane (Freon-12)	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	1.8E+01 N	2.9E+01	NCSSL	NO	DLBSL
	100-41-4	Ethylbenzene	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	5.4E+00 C	8.1E+00	NCSSL	NO	DLBSL
	98-82-8	Isopropylbenzene	ND	ND	MG/KG	MR02-IR69-SS02-10A	0/5	0.0047 - 0.34	3.4E-01	N/A	2.1E+02 NS	1.3E+00	NCSSL	NO	DLBSL
	m&pXYLENE	m- and p-Xylene	ND	ND	MG/KG		0/5	0.0094 - 0.68	6.8E-01	N/A	3.4E+02 NS	6.0E+00	NCSSL	NO	DLBSL
	79-20-9	Methyl acetate	4.7E-03 J	7.1E-01	MG/KG		5/5	0.0047 - 0.34	7.1E-01	N/A	7.8E+03 NS	N/A	NCSSL	NO	BSL
	108-87-2	Methylcyclohexane	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	5.7E+01 NS	N/A	NCSSL	NO	DLBSL
	75-09-2	Methylene chloride	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	1.1E+01 C	2.3E-02	NCSSL	NO	DLBSL
	1634-04-4	Methyl-tert-butyl ether (MTBE)	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	4.3E+01 C	8.5E-02	NCSSL	NO	DLBSL
	95-47-6	o-Xylene	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	3.8E+02 NS	6.0E+00	NCSSL	NO	DLBSL
	100-42-5	Styrene	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	6.3E+02 NS	9.2E-01	NCSSL	NO	DLBSL
	127-18-4	Tetrachloroethene	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	5.5E-01 C	5.0E-03	NCSSL	NO	DLBSL
	108-88-3	Toluene	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	5.0E+02 NS	5.5E+00	NCSSL	NO	DLBSL
	156-60-5	trans-1,2-Dichloroethene	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	1.5E+01 N	5.1E-01	NCSSL	NO	DLBSL

TABLE 2.1

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site UXO-02

MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
 Medium: Surface Soil
 Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	10061-02-6	trans-1,3-Dichloropropene	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	1.7E+00 C*	2.3E-03	NCSSL	NO	DLBSL
	79-01-6	Trichloroethene	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	2.8E+00 C	1.8E-02	NCSSL	NO	DLBSL
	75-69-4	Trichlorofluoromethane(Freon-11)	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	7.9E+01 N	2.4E+01	NCSSL	NO	DLBSL
	75-01-4	Vinyl chloride	ND	ND	MG/KG		0/4	0.0054 - 0.34	3.4E-01	N/A	6.0E-02 C	1.9E-04	NCSSL	YES	DLASL
	1330-20-7	Xylene, total	ND	ND	MG/KG		0/5	0.0047 - 0.34	3.4E-01	N/A	6.3E+01 NS	6.0E+00	NCSSL	NO	DLBSL
	92-52-4	1,1-Biphenyl	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	2.1E+02 NS	4.3E+01	NCSSL	NO	DLBSL
	108-60-1	2,2'-Oxybis(1-chloropropane)	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	4.6E+00 C	N/A		NO	DLBSL
	95-95-4	2,4,5-Trichlorophenol	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	6.1E+02 N	N/A		NO	DLBSL
	88-06-2	2,4,6-Trichlorophenol	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	6.1E+00 C**	N/A		NO	DLBSL
	120-83-2	2,4-Dichlorophenol	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	1.8E+01 N	N/A		NO	DLBSL
	105-67-9	2,4-Dimethylphenol	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	1.2E+02 N	1.4E+00	NCSSL	NO	DLBSL
	51-28-5	2,4-Dinitrophenol	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	1.2E+01 N	N/A		NO	DLBSL
	121-14-2	2,4-Dinitrotoluene	ND	ND	MG/KG		0/205	0.2 - 3.4	3.4E+00	N/A	1.6E+00 C*	N/A		YES	DLASL
	606-20-2	2,6-Dinitrotoluene	ND	ND	MG/KG		0/205	0.2 - 3.4	3.4E+00	N/A	6.1E+00 N	N/A		NO	DLBSL
	91-58-7	2-Chloronaphthalene	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	1.8E+02 NS	N/A		NO	DLBSL
	95-57-8	2-Chlorophenol	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	3.9E+01 N	4.1E-03	NCSSL	NO	DLBSL
	91-57-6	2-Methylnaphthalene	1.9E-03 J	3.6E-03 J	MG/KG	MR02-IR69-SS06-10A	4/5	0.0099 - 0.011	3.6E-03	N/A	3.1E+01 N	1.6E+00	NCSSL	NO	BSL
	95-48-7	2-Methylphenol	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	3.1E+02 N	N/A		NO	DLBSL
	88-74-4	2-Nitroaniline	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	6.1E+01 N	N/A		NO	DLBSL
	88-75-5	2-Nitrophenol	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	3.9E+01 N	N/A		NO	DLBSL
	91-94-1	3,3'-Dichlorobenzidine	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	1.1E+00 C	N/A		NO	DLBSL
	99-09-2	3-Nitroaniline	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	6.1E+01 N	N/A		NO	DLBSL
	534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	4.9E-01 N	N/A		NO	DLBSL
	101-55-3	4-Bromophenyl-phenylether	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	N/A	N/A		NO	NTX
	59-50-7	4-Chloro-3-methylphenol	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	6.1E+02 N	N/A		NO	DLBSL
	106-47-8	4-Chloroaniline	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	2.4E+00 C	N/A		NO	DLBSL
	7005-72-3	4-Chlorophenyl-phenylether	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	3.1E+01 N	N/A		NO	DLBSL
	106-44-5	4-Methylphenol	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	3.1E+01 N	4.0E-01		NO	DLBSL
	100-01-6	4-Nitroaniline	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	2.4E+01 C*	N/A		NO	DLBSL
	100-02-7	4-Nitrophenol	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	4.8E+00 C*	N/A		NO	DLBSL
	83-32-9	Acenaphthene	8.0E-04 J	2.3E-03 J	MG/KG	MR02-IR69-SS05-10A	5/5	0.0099 - 0.011	2.3E-03	N/A	3.4E+02 N	8.4E+00	NCSSL	NO	BSL
	208-96-8	Acenaphthylene	9.3E-04 J	1.1E-03 J	MG/KG	MR02-IR69-SS04-10A : MR02-IR69-SS06-10A	3/5	0.0099 - 0.011	1.1E-03	N/A	3.4E+02 N	1.1E+01	NCSSL	NO	BSL
	98-96-2	Acetophenone	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	7.8E+02 NS	N/A		NO	DLBSL
	120-12-7	Anthracene	6.8E-04 J	1.7E-03 J	MG/KG	MR02-IR69-SS06-10A	4/5	0.0099 - 0.011	1.7E-03	N/A	1.7E+03 N	6.6E+02	NCSSL	NO	BSL
	1912-24-9	Atrazine	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	2.1E+00 C	2.5E-02	NCSSL	NO	DLBSL
	100-52-7	Benzaldehyde	3.6E-02 J	1.7E-01 J	MG/KG	MR02-IR69-SS06-10A	5/5	0.2 - 0.22	1.7E-01	N/A	7.8E+02 NS	N/A		NO	BSL
	56-55-3	Benzo(a)anthracene	8.1E-04 J	3.2E-03 J	MG/KG	MR02-IR69-SS01D-10A	5/5	0.0099 - 0.011	3.2E-03	N/A	1.5E-01 C	1.8E-01	NCSSL	NO	BSL
	50-32-8	Benzo(a)pyrene	1.6E-03 J	7.3E-03 J	MG/KG	MR02-IR69-SS04-10A	5/5	0.0099 - 0.011	7.3E-03	N/A	1.5E-02 C	5.9E-02	NCSSL	NO	BSL
	205-99-2	Benzo(b)fluoranthene	2.1E-03 J	6.2E-03 J	MG/KG	MR02-IR69-SS06-10A	5/5	0.0099 - 0.011	6.2E-03	N/A	1.5E-01 C	6.0E-01	NCSSL	NO	BSL
	191-24-2	Benzo(g,h,i)perylene	8.2E-04 J	1.7E-03 J	MG/KG	MR02-IR69-SS06-10A	2/5	0.0099 - 0.011	1.7E-03	N/A	1.7E+02 N	3.6E+02	NCSSL	NO	BSL
	207-08-9	Benzo(k)fluoranthene	1.9E-03 J	3.9E-03 J	MG/KG	MR02-IR69-SS04-10A	5/5	0.0099 - 0.011	3.9E-03	N/A	1.5E+00 C	5.9E+00	NCSSL	NO	BSL
	111-91-1	bis(2-Chloroethoxy)methane	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	1.8E+01 N	N/A		NO	DLBSL
	111-44-4	bis(2-Chloroethyl)ether	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	2.1E-01 C	1.4E-04	NCSSL	YES	DLASL
	117-81-7	bis(2-Ethylhexyl)phthalate	2.0E-01 J	3.1E-01	MG/KG	MR02-IR69-SS06-10A	2/5	0.2 - 0.22	3.1E-01	N/A	3.5E+01 C*	7.2E+00	NCSSL	NO	BSL
	85-68-7	Butylbenzylphthalate	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	2.6E+02 C*	1.5E+02	NCSSL	NO	DLBSL

TABLE 2.1

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site UXO-02

MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
 Medium: Surface Soil
 Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection [5]
	105-60-2	Caprolactam	ND	ND	MG/KG	MR02-IR69-SS04-10A	0/5	0.2 - 0.22	2.2E-01	N/A	3.1E+03 N	1.8E+01	NCSSL	NO	DLBSL
	86-74-8	Carbazole	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	N/A	N/A		NO	NTX
	218-01-9	Chrysene	2.1E-03 J	4.2E-03 J	MG/KG		5/5	0.0099 - 0.011	4.2E-03	N/A	1.5E+01 C	1.8E+01	NCSSL	NO	BSL
	53-70-3	Dibenz(a,h)anthracene	ND	ND	MG/KG		0/5	0.0099 - 0.011	1.1E-02	N/A	1.5E-02 C	1.9E-01	NCSSL	NO	DLBSL
	132-64-9	Dibenzofuran	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	7.8E+00 N	4.7E+00	NCSSL	NO	DLBSL
	84-66-2	Diethylphthalate	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	4.9E+03 N	3.7E+01	NCSSL	NO	DLBSL
	60-51-5	Dimethoate	ND	ND	MG/KG		0/5	0.077 - 0.1	1.0E-01	N/A	1.2E+00 N	N/A		NO	DLBSL
	131-11-3	Dimethyl phthalate	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	N/A	N/A		NO	NTX
	84-74-2	Di-n-butylphthalate	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	6.1E+02 N	1.9E+01	NCSSL	NO	DLBSL
	117-84-0	Di-n-octylphthalate	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	3.5E+01 C*	3.8E+01	NCSSL	NO	DLBSL
	52-85-7	Famphur	ND	ND	MG/KG	MR02-IR69-SS01-10A	0/5	0.077 - 0.1	1.0E-01	N/A	N/A	N/A		NO	NTX
	206-44-0	Fluoranthene	3.9E-03 J	5.7E-03 J	MG/KG		5/5	0.0099 - 0.011	5.7E-03	N/A	2.3E+02 N	3.3E+02	NCSSL	NO	BSL
	86-73-7	Fluorene	5.6E-04 J	1.2E-03 J	MG/KG		4/5	0.0099 - 0.011	1.2E-03	N/A	2.3E+02 N	5.6E+01	NCSSL	NO	BSL
	118-74-1	Hexachlorobenzene	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	3.0E-01 C	2.6E-03	NCSSL	NO	DLBSL
	87-68-3	Hexachlorobutadiene	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	6.1E+00 C**	8.7E-03	NCSSL	NO	DLBSL
	77-47-4	Hexachlorocyclopentadiene	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	3.7E+01 N	N/A		NO	DLBSL
	67-72-1	Hexachloroethane	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	6.1E+00 C**	N/A		NO	DLBSL
	193-39-5	Indeno(1,2,3-cd)pyrene	8.6E-04 J	2.1E-03 J	MG/KG		3/5	0.0099 - 0.011	2.1E-03	N/A	1.5E-01 C	2.0E+00	NCSSL	NO	BSL
	78-59-1	Isophorone	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	5.1E+02 C*	2.1E-01	NCSSL	NO	DLBSL
	91-20-3	Naphthalene	2.6E-03 J	2.6E-03 J	MG/KG		1/5	0.0099 - 0.011	2.6E-03	N/A	3.6E+00 C*	2.1E-01	NCSSL	NO	BSL
	621-64-7	n-Nitroso-di-n-propylamine	ND	ND	MG/KG	MR02-IR69-SS01D-10A	0/5	0.2 - 0.22	2.2E-01	N/A	6.9E-02 C	N/A		YES	DLASL
	86-30-6	n-Nitrosodiphenylamine	ND	ND	MG/KG		0/5	0.2 - 0.22	2.2E-01	N/A	9.9E+01 C	N/A		NO	DLBSL
	98-95-3	Nitrobenzene	ND	ND	MG/KG		0/205	0.2 - 3.4	3.4E+00	N/A	4.8E+00 C*	N/A		NO	DLBSL
	87-86-5	Pentachlorophenol	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	3.0E+00 C	3.1E-02	NCSSL	NO	DLBSL
	85-01-8	Phenanthrene	3.2E-03 J	6.0E-03 J	MG/KG		5/5	0.0099 - 0.011	6.0E-03	N/A	1.7E+03 N	5.7E+01	NCSSL	NO	BSL
	108-95-2	Phenol	ND	ND	MG/KG		0/5	0.39 - 0.43	4.3E-01	N/A	1.8E+03 N	2.3E-01	NCSSL	NO	DLBSL
	298-02-2	Phorate	ND	ND	MG/KG		0/5	0.038 - 0.049	4.9E-02	N/A	1.2E+00 N	1.3E-02	NCSSL	NO	DLBSL
	129-00-0	Pyrene	2.7E-03 J	4.4E-03 J	MG/KG		5/5	0.0099 - 0.011	4.4E-03	N/A	1.7E+02 N	2.2E+02	NCSSL	NO	BSL
	72-54-8	4,4'-DDD	1.9E-03 NJ	2.7E-03 NJ	MG/KG		3/5	0.0039 - 0.021	2.7E-03	N/A	2.0E+00 C	2.4E-01	NCSSL	NO	BSL
	72-55-9	4,4'-DDE	2.5E-03 NJ	7.3E-02 NJ	MG/KG		5/5	0.0039 - 0.021	7.3E-02	N/A	1.4E+00 C	N/A		NO	BSL
	50-29-3	4,4'-DDT	3.3E-03 J	3.9E-02 J	MG/KG	MR02-IR69-SS01D-10A	5/5	0.0039 - 0.021	3.9E-02	N/A	1.7E+00 C*	3.4E-01	NCSSL	NO	BSL
	309-00-2	Aldrin	2.2E-04 J	1.0E-03 J	MG/KG		2/5	0.002 - 0.011	1.0E-03	N/A	2.9E-02 C*	N/A		NO	BSL
	319-84-6	alpha-BHC	5.8E-04 J	3.3E-03 J	MG/KG		3/5	0.002 - 0.011	3.3E-03	N/A	7.7E-02 C	1.2E-03	NCSSL	NO	BSL
	5103-71-9	alpha-Chlordane	1.2E-03 J	1.0E-02 J	MG/KG		4/5	0.002 - 0.011	1.0E-02	N/A	1.6E+00 C*	6.8E-02	NCSSL	NO	BSL
	12674-11-2	Aroclor-1016	ND	ND	MG/KG		0/5	0.029 - 0.16	1.6E-01	N/A	3.9E-01 N	N/A		NO	DLBSL
	11104-28-2	Aroclor-1221	ND	ND	MG/KG		0/5	0.04 - 0.22	2.2E-01	N/A	1.4E-01 C	N/A		YES	DLASL
	11141-16-5	Aroclor-1232	ND	ND	MG/KG		0/5	0.02 - 0.11	1.1E-01	N/A	1.4E-01 C	N/A		NO	DLBSL
	53469-21-9	Aroclor-1242	ND	ND	MG/KG		0/5	0.02 - 0.11	1.1E-01	N/A	2.2E-01 C	N/A		NO	DLBSL
	12672-29-6	Aroclor-1248	ND	ND	MG/KG		0/5	0.02 - 0.11	1.1E-01	N/A	2.2E-01 C	N/A		NO	DLBSL
	11097-69-1	Aroclor-1254	ND	ND	MG/KG		0/5	0.02 - 0.11	1.1E-01	N/A	1.1E-01 C**	N/A		YES	DLASL
	11096-82-5	Aroclor-1260	ND	ND	MG/KG	MR02-IR69-SS02-10A	0/5	0.02 - 0.11	1.1E-01	N/A	2.2E-01 C	N/A		NO	DLBSL
	86-50-0	Azinphos methyl	ND	ND	MG/KG		0/5	0.038 - 0.049	4.9E-02	N/A	1.8E+01 N	N/A		NO	DLBSL
	319-85-7	beta-BHC	2.0E-03 J	2.0E-03 J	MG/KG		1/5	0.001 - 0.0055	2.0E-03	N/A	2.7E-01 C	1.2E-03	NCSSL	NO	BSL
	35400-43-2	Bolstar	ND	ND	MG/KG		0/5	0.038 - 0.049	4.9E-02	N/A	N/A	N/A		NO	NTX
	2921-88-2	Chlorpyrifos	ND	ND	MG/KG		0/5	0.038 - 0.049	4.9E-02	N/A	1.8E+01 N	N/A		NO	DLBSL

TABLE 2.1

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site UXO-02

MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
 Medium: Surface Soil
 Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background Value [3]	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	56-72-4	Coumaphos	ND	ND	MG/KG			0/5	0.038 - 0.049	4.9E-02	N/A	N/A		NO	NTX
	319-86-8	delta-BHC	9.8E-04 J	2.1E-03 J	MG/KG	MR02-IR69-SS02-10A	3/5	0.002 - 0.011	2.1E-03	N/A	2.7E-01 C	1.2E-03	NCSSL	NO	BSL
	DEMETON-O	Demeton-O	ND	ND	MG/KG		0/5	0.095 - 0.12	1.2E-01	N/A	N/A	N/A		NO	NTX
	DEMETON-S	Demeton-S	ND	ND	MG/KG		0/5	0.095 - 0.12	1.2E-01	N/A	N/A	N/A		NO	NTX
	333-41-5	Diazinon	ND	ND	MG/KG		0/5	0.038 - 0.049	4.9E-02	N/A	4.3E+00 N	N/A		NO	DLBSL
	62-73-7	Dichlorvos	ND	ND	MG/KG		0/5	0.077 - 0.1	1.0E-01	N/A	1.7E+00 C*	N/A		NO	DLBSL
	60-57-1	Dieldrin	ND	ND	MG/KG		0/5	0.0039 - 0.021	2.1E-02	N/A	3.0E-02 C	8.1E-04	NCSSL	NO	DLBSL
	298-04-4	Disulfoton	ND	ND	MG/KG		0/5	0.077 - 0.1	1.0E-01	N/A	2.4E-01 N	6.2E-03	NCSSL	NO	DLBSL
	959-98-8	Endosulfan I	2.7E-04 J	1.7E-03 J	MG/KG	MR02-IR69-SS06-10A	3/5	0.002 - 0.011	1.7E-03	N/A	3.7E+01 N	5.6E+00	NCSSL	NO	BSL
	33213-65-9	Endosulfan II	1.2E-03 J	1.2E-03 J	MG/KG	MR02-IR69-SS05-10A	1/5	0.0039 - 0.021	1.2E-03	N/A	3.7E+01 N	5.6E+00	NCSSL	NO	BSL
	1031-07-8	Endosulfan sulfate	3.8E-03 J	4.3E-02 J	MG/KG	MR02-IR69-SS04-10A	5/5	0.0039 - 0.021	4.3E-02	N/A	3.7E+01 N	5.6E+00	NCSSL	NO	BSL
	72-20-8	Endrin	8.7E-04 J	1.5E-03 J	MG/KG	MR02-IR69-SS06-10A	2/5	0.0039 - 0.021	1.5E-03	N/A	1.8E+00 N	8.1E-01	NCSSL	NO	BSL
	7421-93-4	Endrin aldehyde	2.2E-03 J	3.1E-03 J	MG/KG	MR02-IR69-SS06-10A	2/5	0.0039 - 0.021	3.1E-03	N/A	1.8E+00 N	8.1E-01	NCSSL	NO	BSL
	53494-70-5	Endrin ketone	2.5E-03 J	2.0E-02 J	MG/KG	MR02-IR69-SS01D-10A	5/5	0.0039 - 0.021	2.0E-02	N/A	1.8E+00 N	8.1E-01	NCSSL	NO	BSL
	13194-48-4	Ethoprop	ND	ND	MG/KG		0/5	0.02 - 0.025	2.5E-02	N/A	N/A	N/A		NO	NTX
	115-90-2	Fensulfothion	ND	ND	MG/KG		0/5	0.2 - 0.25	2.5E-01	N/A	N/A	N/A		NO	NTX
	2104-64-5	Ethyl p-nitrophenyl phenylphosphorothioate	ND	ND	MG/KG		0/5	0.038 - 0.049	4.9E-02	N/A	6.1E-02 N	N/A		NO	DLBSL
	55-38-9	Fenthion	ND	ND	MG/KG		0/5	0.038 - 0.049	4.9E-02	N/A	N/A	N/A		NO	NTX
	58-89-9	gamma-BHC (Lindane)	1.4E-03 J	1.6E-03 J	MG/KG	MR02-IR69-SS06-10A	2/5	0.002 - 0.011	1.6E-03	N/A	5.2E-01 C*	1.8E-03	NCSSL	NO	BSL
	5103-74-2	gamma-Chlordane	2.1E-03 J	3.9E-03 J	MG/KG	MR02-IR69-SS04-10A	4/5	0.002 - 0.011	3.9E-03	N/A	1.6E+00 C*	1.2E-03	NCSSL	NO	BSL
	76-44-8	Heptachlor	1.1E-03 J	1.5E-03 J	MG/KG	MR02-IR69-SS02-10A	2/5	0.002 - 0.011	1.5E-03	N/A	1.1E-01 C	6.6E-03	NCSSL	NO	BSL
	1024-57-3	Heptachlor epoxide	1.6E-03 J	1.6E-03 J	MG/KG	MR02-IR69-SS06-10A	1/5	0.002 - 0.011	1.6E-03	N/A	5.3E-02 C*	8.2E-04	NCSSL	NO	BSL
	121-75-5	Malathion	ND	ND	MG/KG		0/5	0.038 - 0.049	4.9E-02	N/A	1.2E+02 N	N/A		NO	DLBSL
	150-50-5	Merphos	ND	ND	MG/KG		0/5	0.057 - 0.075	7.5E-02	N/A	1.8E-01 N	N/A		NO	DLBSL
	72-43-5	Methoxychlor	ND	ND	MG/KG		0/5	0.02 - 0.11	1.1E-01	N/A	3.1E+01 N	2.2E+01	NCSSL	NO	DLBSL
	298-00-0	Methyl parathion	ND	ND	MG/KG		0/5	0.02 - 0.025	2.5E-02	N/A	1.5E+00 N	N/A		NO	DLBSL
	7786-34-7	Mevinphos	ND	ND	MG/KG		0/5	0.077 - 0.1	1.0E-01	N/A	N/A	N/A		NO	NTX
		Monocrotophos	ND	ND	MG/KG		0/5	0.38 - 0.49	4.9E-01	N/A	N/A	N/A		NO	NTX
	300-76-5	Naled	ND	ND	MG/KG		0/5	0.2 - 0.25	2.5E-01	N/A	1.2E+01 N	N/A		NO	DLBSL
	56-38-2	Parathion	ND	ND	MG/KG		0/5	0.038 - 0.049	4.9E-02	N/A	3.7E+01 N	N/A		NO	DLBSL
	299-84-3	Ronnel	ND	ND	MG/KG		0/5	0.038 - 0.049	4.9E-02	N/A	3.1E+02 N	N/A		NO	DLBSL
	3689-24-5	Sulfotepp	ND	ND	MG/KG		0/5	0.02 - 0.025	2.5E-02	N/A	3.1E+00 N	N/A		NO	DLBSL
	22248-79-9	Tetrachlorvinphos	ND	ND	MG/KG		0/5	0.038 - 0.049	4.9E-02	N/A	N/A	N/A		NO	NTX
	297-97-2	Thionazin	ND	ND	MG/KG		0/5	0.038 - 0.049	4.9E-02	N/A	N/A	N/A		NO	NTX
	34643-46-4	Tokuthion (Prothiophos)	ND	ND	MG/KG		0/5	0.038 - 0.049	4.9E-02	N/A	N/A	N/A		NO	NTX
	8001-35-2	Toxaphene	ND	ND	MG/KG		0/5	0.099 - 0.54	5.4E-01	N/A	4.4E-01 C	4.6E-02	NCSSL	YES	DLASL
	327-98-0	Trichloronate	ND	ND	MG/KG		0/5	0.038 - 0.049	4.9E-02	N/A	N/A	N/A		NO	NTX
	99-35-4	1,3,5-Trinitrobenzene	ND	ND	MG/KG		0/205	0.45 - 3.4	3.4E+00	N/A	2.2E+02 N	N/A		NO	DLBSL
	99-65-0	1,3-Dinitrobenzene	ND	ND	MG/KG		0/205	0.45 - 3.4	3.4E+00	N/A	6.1E-01 N	N/A		YES	DLASL
	118-96-7	2,4,6-Trinitrotoluene	ND	ND	MG/KG		0/205	0.45 - 3.4	3.4E+00	N/A	3.6E+00 C**	N/A		NO	DLBSL
	35572-78-2	2-Amino-4,6-dinitrotoluene	ND	ND	MG/KG		0/205	0.45 - 3.4	3.4E+00	N/A	1.5E+01 N	N/A		NO	DLBSL
	88-72-2	2-Nitrotoluene	ND	ND	MG/KG		0/205	0.45 - 3.4	3.4E+00	N/A	2.9E+00 C*	N/A		YES	DLASL
	99-08-1	3-Nitrotoluene	ND	ND	MG/KG		0/205	0.45 - 3.4	3.4E+00	N/A	6.1E-01 N	N/A		YES	DLASL
	19406-51-0	4-Amino-2,6-dinitrotoluene	ND	ND	MG/KG		0/205	0.00026 - 0.00026	2.6E-04	N/A	1.5E+01 N	N/A		NO	DLBSL
	99-99-0	4-Nitrotoluene	ND	ND	MG/KG		0/205	0.45 - 3.4	3.4E+00	N/A	2.4E+01 C**	N/A		NO	DLBSL

TABLE 2.1

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site UXO-02

MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
 Medium: Surface Soil
 Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	2691-41-0	HMX	ND	ND	MG/KG		0/205	0.45 - 3.4	3.4E+00	N/A	3.8E+02 N	N/A		NO	DLBSL
	55-63-0	Nitroglycerin	8.6E-01 J	8.6E-01 J	MG/KG	MR02-IR69-SS17-10A	1/205	0.72 - 5.4	8.6E-01	N/A	6.1E-01 N	N/A		YES	ASL
	14797-73-0	Perchlorate	ND	ND	MG/KG		0/205	0.0021 - 0.019	1.9E-02	N/A	5.5E+00 N	N/A		NO	DLBSL
	78-11-5	PETN	ND	ND	MG/KG		0/205	1.4 - 10	1.0E+01	N/A	N/A	N/A		NO	NTX
	121-82-4	RDX	ND	ND	MG/KG		0/205	0.45 - 3.4	3.4E+00	N/A	5.5E+00 C*	N/A		NO	DLBSL
	479-45-8	Tetryl	ND	ND	MG/KG		0/205	0.45 - 3.4	3.4E+00	N/A	2.4E+01 N	N/A		NO	DLBSL
	7429-90-5	Aluminum	2.1E+02 J	1.4E+04	MG/KG	MR02-SS12-10A	205/205	27 - 270	1.4E+04	5.5E+03	7.7E+03 N	N/A		YES	ASL
	7440-36-0	Antimony	1.0E-01 J	3.2E+00 J	MG/KG	MR02-SS121D-10A	16/205	10 - 10	3.2E+00	4.5E-01	3.1E+00 N	N/A		YES	ASL
	7440-38-2	Arsenic	1.6E-01 J	8.3E+00 J	MG/KG	MR02-SS24-10A	172/205	0.34 - 3.4	8.3E+00	6.3E-01	3.9E-01 C*	5.8E+00	NCSSL	YES	ASL
	7440-39-3	Barium	1.7E+00 J	9.3E+01	MG/KG	MR02-SS05-10A	148/205	27 - 270	9.3E+01	1.5E+01	1.5E+03 N	5.8E+02	NCSSL	NO	BSL
	7440-41-7	Beryllium	1.0E-02 J	5.1E-01 J	MG/KG	MR02-SS05-10A : MR02-SS07-10A	41/205	0.68 - 6.9	5.1E-01	1.0E-01	1.6E+01 N	N/A		NO	BSL
	7440-43-9	Cadmium	1.0E-02 J	1.3E-01 J	MG/KG	MR02-SS176-10A	34/205	1 - 1	1.3E-01	3.3E-02	7.0E+00 N	3.0E+00	NCSSL	NO	BSL
	7440-70-2	Calcium	1.0E+03 J	4.0E+04	MG/KG	MR02-IR69-SS15-10A	25/205	680 - 6900	4.0E+04	6.4E+03	N/A	N/A		NO	NUT
	7440-47-3	Chromium	3.4E-01 J	1.3E+01	MG/KG	MR02-SS24-10A	146/205	1.4 - 14	1.3E+01	6.1E+00	2.9E-01 C	3.8E+00	NCSSL	YES	ASL
	7440-48-4	Cobalt	3.0E-02 J	2.0E+00 J	MG/KG	MR02-SS92-10A	125/205	6.8 - 69	2.0E+00	2.9E-01	2.3E+00 N	N/A		NO	BSL
	7440-50-8	Copper	1.2E+00 J	7.8E+00	MG/KG	MR02-SS183-10A	13/205	25 - 25	7.8E+00	4.8E+00	3.1E+02 N	7.0E+02	NCSSL	NO	BSL
	7439-89-6	Iron	1.4E+02	2.1E+04	MG/KG	MR02-SS24-10A	205/205	14 - 140	2.1E+04	3.2E+03	5.5E+03 N	1.5E+02	NCSSL	YES	ASL
	7439-92-1	Lead	2.2E+00	2.2E+02	MG/KG	MR02-IR69-SS17-10A	205/205	0.41 - 4.1	2.2E+02	1.2E+01	4.0E+02 NL	2.7E+02	NCSSL	NO	BSL
	7439-95-4	Magnesium	ND	ND	MG/KG		0/205	680 - 6900	6.9E+03	2.4E+02	N/A	N/A		NO	NUT
	7439-96-5	Manganese	4.9E+00	5.9E+02	MG/KG	MR02-SS149-10A	205/205	2 - 21	5.9E+02	1.4E+01	1.8E+02 N	6.5E+01	NCSSL	YES	ASL
	7439-97-6	Mercury	1.0E-02 J	1.4E-01 J	MG/KG	MR02-SS171-10A	169/205	0.13 - 1	1.4E-01	8.1E-02	2.3E+00 N	1.0E+00	NCSSL	NO	BSL
	7440-02-0	Nickel	1.9E-01 J	9.3E+00	MG/KG	MR02-SS24-10A	76/205	5.4 - 55	9.3E+00	1.2E+00	1.5E+02 N	1.3E+02	NCSSL	NO	BSL
	7440-09-7	Potassium	3.2E+01 J	5.9E+02 J	MG/KG	MR02-IR69-SS15-10A	44/205	5000 - 5000	5.9E+02	1.2E+02	N/A	N/A		NO	NUT
	7782-49-2	Selenium	1.0E-01 J	5.7E-01 J	MG/KG	MR02-SS12-10A	114/205	0.68 - 6.9	5.7E-01	5.6E-01	3.9E+01 N	2.1E+00	NCSSL	NO	BSL
	7440-22-4	Silver	6.0E-02 J	6.0E-02 J	MG/KG	MR02-SS44-10A	1/205	1.4 - 14	6.0E-02	1.4E-01	3.9E+01 N	3.4E+00	NCSSL	NO	BSL
	7440-23-5	Sodium	5.3E+00 J	1.7E+02 J	MG/KG	MR02-SS81D-10A	24/205	680 - 6900	1.7E+02	8.1E+01	N/A	N/A		NO	NUT
	7440-28-0	Thallium	2.0E-02 J	5.0E-02 J	MG/KG	MR02-IR69-SS01-10A	3/205	0.34 - 3.4	5.0E-02	3.6E-01	N/A	N/A		NO	NTX
	7440-62-2	Vanadium	5.4E-01 J	1.8E+01	MG/KG	MR02-SS07-10A	147/205	50 - 50	1.8E+01	8.9E+00	3.9E+01 N	N/A		NO	BSL
	7440-66-6	Zinc	1.4E+00 J	5.3E+01	MG/KG	MR02-SS14-10A	147/205	2.7 - 27	5.3E+01	1.1E+01	2.3E+03 N	1.2E+03	NCSSL	NO	BSL

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening. If ND, maximum detection limit used for screening.

[3] Background values are two times the arithmetic mean base-wide background surface soil concentrations.

Background values are from *Final Base Background Soil Study Report, Marine Corps Base Camp Lejeune, North Carolina*, Baker Environmental, April 25, 2001.

[4] Oak Ridge National Laboratory (ORNL). May 17, 2010. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites.

Available: <http://epa-prgs.org/chemicals/index.shtml>. Adjusted (noncarcinogenic RSLs adjusted by dividing by 10) residential soil RSLs.

RSL for 1,4-Dichlorobenzene used as surrogate for 1,3-Dichlorobenzene.

RSL value for n-Hexane used as surrogate for Methylcyclohexane.

RSL value for Methyl Isobutyl Ketone (4-methyl-2-pentanone) used as surrogate for 2-Hexanone.

RSL value for 2-Nitroaniline used as surrogate for 3-Nitroaniline.

RSL value for methoxychlor used as surrogate for 4-Chlorophenyl-phenylether.

RSL value for Nitrobenzene used as surrogate for 4-Nitrophenol.

RSL value for Acenaphthene used as surrogate for Acenaphthylene.

RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.

RSL value for anthracene used as surrogate for phenanthrene.

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/

To Be Considered

NCSSL = North Carolina Soil Screening Levels (NCDENR, 2010)

J = Estimated Value

N/A = Not Applicable/Not Available

ND = Not Detected

NJ = analyte tentatively identified, estimated value

NL = Noncarcinogenic lead residential soil RSL not adjusted by dividing by 10.

C = Carcinogenic

N = Noncarcinogenic

C* = N screening level < 100x C screening level

C** = N screening level < 10x C screening level, therefore

N screening value/10 used as screening level

S or NS = concentration exceeds Csat, used Csat as screening value

TABLE 2.1
 Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Site UXO-02
MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
 Medium: Surface Soil
 Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
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RSL value for technical chlordane used as surrogate for alpha-chlordane.

RSL value for technical-HCH used as surrogate for delta-BHC.

RSL value for technical chlordane used as surrogate for gamma-chlordane.

RSL value for Chromium(VI) used as surrogate for chromium.

The soil value of 400 mg/kg for lead is from the Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, USEPA, July 14, 1994.

RSL value for Manganese (water) used as surrogate for manganese.

RSL value for Mercury (inorganic salts) used as surrogate for mercury.

RSL value for 1,3-dichloropropene used as a surrogate for cis-1,3-dichloropropene and trans-1,3-dichloropropene.

RSL value for endosulfan used as surrogate for endosulfan I, endosulfan II, and endosulfan sulfate.

RSL value for endrin used as surrogate for endrin aldehyde and endrin ketone.

RSL value for 2-chlorophenol used as surrogate for 4-chloro-3-methylphenol and 2-nitrophenol.

[5]	Rationale Codes	Selection Reason:	Above Screening Levels (ASL) Detection Limit Above Screening Level (DLASL), not quantitatively evaluated in HHRA Chemical from same class (carcinogenic PAH) identified as a COPC (OPAH)												
		Deletion Reason:	No Toxicity Information (NTX) Essential Nutrient (NUT) Below Screening Level (BSL) Below Background (BBK) Detection Limit Below Screening Level (DLBSL)												

Generated by: D. Stannard
 Checked by: G. Howard-Peebles

TABLE 2.1a

Risk Ratio Screening for Surface Soil, Maximum Detected Concentration

Site UXO-02

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample	Residential Soil RSL	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Risk ^b	Target Organ
Explosives (mg/kg)								
Nitroglycerin	1 / 205	8.6E-01 J	MR02-IR69-SS17-10A	6.1E+00	1	0.1	NA	Cardiovascular System
Metals (mg/kg)								
Aluminum	205 / 205	1.4E+04	MR02-SS12-10A	7.7E+04	1	0.2	NA	Neurological, Developmental
Antimony	16 / 205	3.2E+00 J	MR02-SS121D-10A	3.1E+01	1	0.1	NA	Longevity, Blood
Arsenic	172 / 205	8.3E+00 J	MR02-SS24-10A	3.9E-01	1.E-06	NA	2.E-05	NA
Chromium	146 / 205	1.3E+01	MR02-SS24-10A	2.9E-01	1.E-06	NA	4.E-05	NA
Iron	205 / 205	2.1E+04	MR02-SS24-10A	5.5E+04	1	0.4	NA	Gastrointestinal
Manganese	205 / 205	5.9E+02	MR02-SS149-10A	1.8E+03	1	0.3	NA	CNS
Cumulative Corresponding Hazard Index^c						1		
Cumulative Corresponding Cancer Risk^d							7.E-05	
								Total Neurological HI = 0.5
								Total Developmental HI = 0.2
								Total Longevity HI = 0.1
								Total Blood HI = 0.1
								Total Gastrointestinal HI = 0.4
								Total Cardiovascular HI = 0.1

^a Corresponding Hazard Index equals maximum detected concentration divided by the SL divided by the acceptable risk level.^b Corresponding Cancer Risk equals maximum detected concentration divided by the SL divided by the acceptable risk level.^c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.^d Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05,

otherwise, constituent not selected as COPC.

Constituents selected as COPCs are indicated by shading.

CNS = Central Nervous System

COPC = Constituent of Potential Concern

HI = Hazard Index

mg/kg = milligrams per kilogram

RSL = Oak Ridge National Laboratory (ORNL). May 2010. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. [Online].

Available: <http://epa-prgs.ornl.gov/chemicals/index.shtml>

TABLE 2.1b

Risk Ratio Screening for Surface Soil, 95% UCL Concentration

Site UXO-02

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	95% UCL		95% UCL Rationale	Screening Level	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Risk ^b	Target Organ
Metals (mg/kg)									
Arsenic	172 / 205	7.0E-01	95% KM-BCA	1	3.9E-01	1.E-06	NA	2.E-06	NA
Chromium	146 / 205	2.9E+00	95% KM-BCA	4	2.9E-01	1.E-06	NA	1.E-05	NA
Cumulative Corresponding Hazard Index ^c							NA		
Cumulative Corresponding Cancer Risk ^d								1E-05	

^a Corresponding Hazard Index equals 95% UCL divided by the RSL divided by the acceptable risk level.^b Corresponding Cancer Risk equals 95% UCL divided by the RSL divided by the acceptable risk level.^c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.^d Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05,

Constituents selected as COPCs are indicated by shading.

mg/kg = milligrams per kilogram

HI = Hazard Index

ProUCL, Version 4.00.05 used to determine distribution of data and calculate 95% UCL, following recommendations

in users guide (USEPA, May 2010. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

Options: 95% KM BCA UCL (95% KM-BCA)

UCL Rationale:

- (1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
- (2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
- (3) Test indicates data are gamma distributed.
- (4) Distribution tests are inconclusive
- (5) Maximum value used because calculated 95% UCL exceeds maximum concentration.

TABLE 2.2

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site UXO-02

MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Surface Water UXO-02	121-14-2	2,4-Dinitrotoluene	ND	ND	UG/L		0/10	0.26 - 0.26	2.6E-01	N/A	1.1E-01 A			YES	DLASL
	606-20-2	2,6-Dinitrotoluene	ND	ND	UG/L		0/10	0.26 - 0.26	2.6E-01	N/A	3.7E+00 R-n			NO	DLBSL
	98-95-3	Nitrobenzene	ND	ND	UG/L		0/10	0.26 - 0.26	2.6E-01	N/A	1.7E+01 A			NO	DLBSL
	99-35-4	1,3,5-Trinitrobenzene	ND	ND	UG/L		0/10	0.26 - 0.26	2.6E-01	N/A	1.1E+02 R-n			NO	DLBSL
	99-65-0	1,3-Dinitrobenzene	ND	ND	UG/L		0/10	0.26 - 0.26	2.6E-01	N/A	3.7E-01 R-n			NO	DLBSL
	118-96-7	2,4,6-Trinitrotoluene	ND	ND	UG/L		0/10	0.26 - 0.26	2.6E-01	N/A	1.8E+00 R-c**			NO	DLBSL
	35572-78-2	2-Amino-4,6-dinitrotoluene	ND	ND	UG/L		0/10	0.26 - 0.26	2.6E-01	N/A	7.3E+00 R-n			NO	DLBSL
	88-72-2	2-Nitrotoluene	ND	ND	UG/L		0/10	0.52 - 0.52	5.2E-01	N/A	3.1E-01 R-c			YES	DLASL
	99-08-1	3-Nitrotoluene	ND	ND	UG/L		0/10	0.52 - 0.52	5.2E-01	N/A	3.7E-01 R-n			YES	DLASL
	19406-51-0	4-Amino-2,6-dinitrotoluene	ND	ND	UG/L		0/10	0.26 - 0.26	2.6E-01	N/A	7.3E+00 R-n			NO	DLBSL
	99-99-0	4-Nitrotoluene	ND	ND	UG/L		0/10	0.52 - 0.52	5.2E-01	N/A	4.2E+00 R-c*			NO	DLBSL
	2691-41-0	HMX	ND	ND	UG/L		0/10	0.52 - 0.52	5.2E-01	N/A	1.8E+02 R-n			NO	DLBSL
	55-63-0	Nitroglycerin	ND	ND	UG/L		0/10	2 - 2	2.0E+00	N/A	3.7E-01 N			YES	DLASL
	14797-73-0	Perchlorate	ND	ND	UG/L		0/10	0.5 - 0.5	5.0E-01	N/A	2.6E+00 R-n			NO	DLBSL
	78-11-5	PETN	ND	ND	UG/L		0/10	4.5 - 4.5	4.5E+00	N/A	N/A			NO	NTX
	121-82-4	RDX	ND	ND	UG/L		0/10	0.52 - 0.52	5.2E-01	N/A	6.1E-01 R-c			NO	DLBSL
	479-45-8	Tetryl	ND	ND	UG/L		0/10	0.52 - 0.52	5.2E-01	N/A	1.5E+01 R-n			NO	DLBSL
	7429-90-5	Aluminum	2.2E+02	2.0E+03 J	UG/L	MR02-SW05-10A	8/10	200 - 200	2.0E+03	N/A	3.7E+03 R-n			NO	BSL
	7440-36-0	Antimony	ND	ND	UG/L		0/10	10 - 10	1.0E+01	N/A	5.6E+00 A			YES	DLASL
	7440-38-2	Arsenic	1.3E+00 J	3.1E+00 J	UG/L	MR02-SW05D-10A	5/10	10 - 10	3.1E+00	N/A	1.8E-02 A	1.0E+01	N	YES	ASL
	7440-39-3	Barium	6.9E+00 J	2.5E+01 J	UG/L	MR02-SW07-10A	9/10	200 - 200	2.5E+01	N/A	1.0E+03 A	1.0E+03	N	NO	BSL
	7440-41-7	Beryllium	ND	ND	UG/L		0/10	5 - 5	5.0E+00	N/A	4.0E+00 A			YES	DLASL
	7440-43-9	Cadmium	ND	ND	UG/L		0/10	1 - 1	1.0E+00	N/A	5.0E+00 A			NO	DLBSL
	7440-70-2	Calcium	7.0E+03	3.5E+04	UG/L	MR02-SW05D-10A	7/10	5000 - 5000	3.5E+04	N/A	N/A			NO	NUT
	7440-47-3	Chromium	4.7E-01 J	4.7E-01 J	UG/L	MR02-SW09-10A	1/10	10 - 10	4.7E-01	N/A	1.0E+02 A			NO	BSL
	7440-48-4	Cobalt	3.7E-01 J	6.7E-01 J	UG/L	MR02-SW07-10A	5/10	50 - 50	6.7E-01	N/A	1.1E+00 R-n			NO	BSL
	7440-50-8	Copper	ND	ND	UG/L		0/10	25 - 25	2.5E+01	N/A	1.3E+03 A			NO	DLBSL
	7439-89-6	Iron	1.3E+02	2.1E+03	UG/L	MR02-SW09-10A	8/10	100 - 100	2.1E+03	N/A	3.0E+02 A			YES	ASL
	7439-92-1	Lead	1.1E+00 J	1.3E+00 J	UG/L	MR02-SW06-10A	2/10	3 - 3	1.3E+00	N/A	1.5E+01 M			NO	BSL
	7439-95-4	Magnesium	9.0E+03	8.9E+04	UG/L	MR02-SW02-10A	7/10	5000 - 5000	8.9E+04	N/A	N/A			NO	NUT
	7439-96-5	Manganese	4.6E+00 J	5.5E+01	UG/L	MR02-SW05-10A	10/10	15 - 15	5.5E+01	N/A	5.0E+01 A			YES	ASL
	7439-97-6	Mercury	ND	ND	UG/L		0/10	0.2 - 0.2	2.0E-01	N/A	1.1E+00 R-n			NO	DLBSL
	7440-02-0	Nickel	5.8E-01 J	1.4E+00 J	UG/L	MR02-SW07-10A	2/10	40 - 40	1.4E+00	N/A	6.1E+02 A			NO	BSL
	7440-09-7	Potassium	1.0E+03 J	3.3E+04	UG/L	MR02-SW02-10A	9/10	5000 - 5000	3.3E+04	N/A	N/A			NO	NUT
	7782-49-2	Selenium	1.2E+00 J	2.9E+00 J	UG/L	MR02-SW02-10A	3/10	5 - 5	2.9E+00	N/A	5.0E+01 A			NO	BSL
	7440-22-4	Silver	ND	ND	UG/L		0/10	10 - 10	1.0E+01	N/A	1.8E+01 R-n			NO	DLBSL

TABLE 2.2

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site UXO-02

MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	7440-23-5	Sodium	9.2E+03	6.9E+05	UG/L	MR02-SW02-10A	10/10	5000 - 5000	6.9E+05	N/A	N/A			NO	NUT
	7440-28-0	Thallium	ND	ND	UG/L		0/10	2 - 2	2.0E+00	N/A	2.4E-01 A			YES	DLASL
	7440-62-2	Vanadium	4.4E-01 J	3.0E+00 J	UG/L	MR02-SW05-10A	7/10	50 - 50	3.0E+00	N/A	1.8E+01 R-n			NO	BSL
	7440-66-6	Zinc	2.3E+00 J	4.0E+01	UG/L	MR02-SW07-10A	9/10	20 - 20	4.0E+01	N/A	7.4E+03 A			NO	BSL

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening. If ND, maximum detection limit used for screening.

[3] Background values not available.

[4] North Carolina WQS for Human Health and Water Supply, Federal Ambient Water Quality Criteria, Consumption of Water and Organisms, or USEPA Regional Screening Levels for Tap Water.
Safe Drinking Water Act Action Level for Lead used as screening level for lead.
RSL value for Chromium(VI) used as surrogate for chromium.
RSL value for Manganese (water) used as surrogate for manganese.
RSL value for Mercury (inorganic salts) used as surrogate for mercury.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Detection Limit Above Screening Level (DLASL), not quantitatively evaluated in HHRA

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Below Background (BBK)
Detection Limit Below Screening Level (DLBSL)

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
To Be Considered

J = Estimated Value

N = North Carolina 15A NCAC 2B Human Health, Amended Feb. 2010.

A = Federal Ambient Water Quality Criteria, Consumption of Water
and Organisms

M = Action level for lead from Federal Drinking Water MCLs

R-n = USEPA Regional Screening Level, noncarcinogenic
(therefore, RSL divided by 10, see text)

R-c = USEPA Regional Screening Level, Carcinogenic

R-c* = R-n screening level < 100x R-c screening level

R-c** = R-n screening level < 10x R-c screening level, therefore
R-n screening value/10 used as screening level

N/A = Not available

TABLE 2.2a

Risk Ratio Screening for Surface Water, Maximum Detected Concentration

Site UXO-02

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample	Screening Level	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Index ^b	Target Organ
Metals (ug/L)								
Arsenic	5 / 10	3.1E+00 J	MR02-SW05D-10A	4.5E-02	1.E-06	NA	7.E-05	NA
Iron	8 / 10	2.1E+03	MR02-SW09-10A	2.6E+04	1	0.1	NA	Gastrointestinal
Manganese	10 / 10	5.5E+01	MR02-SW05-10A	8.8E+02	1	0.1	NA	CNS
Cumulative Corresponding Hazard Index^c						0.1		
Cumulative Corresponding Cancer Risk^d							7.E-05	
Total Gastrointestinal HI =								0.1
Total CNS HI =								0.1

Screening level used for Step 2, risk ratio evaluation is the Tap Water RSL, May 2010. The North Carolina WQS for Human Health and Federal Ambient Water Quality Criteria not risk-based and are not appropriate for use in Step 2.

^a Corresponding Hazard Index equals maximum detected concentration divided by the SL divided by the acceptable risk level.

^b Corresponding Cancer Risk equals maximum detected concentration divided by the SL divided by the acceptable risk level.

^c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.

^d Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05, otherwise, constituent not selected as COPC.

Constituents selected as COPCs are indicated by shading.

CNS = Central Nervous System

COPC = Constituent of Potential Concern

HI = Hazard Index

ug/L = micrograms per liter

TABLE 2.2b

Risk Ratio Screening for Surface Water, 95% UCL Concentration

Site UXO-02

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	95% UCL		95% UCL Rationale	Screening Level	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Risk ^b	Target Organ
Metals (ug/L)									
Arsenic	5 / 10	2.4E+00	95% KM-t	1	4.5E-02	1.E-06	NA	5.E-05	NA
Cumulative Corresponding Hazard Index ^c							NA		
Cumulative Corresponding Cancer Risk ^d								5E-05	

^a Corresponding Hazard Index equals 95% UCL divided by the RSL divided by the acceptable risk level.^b Corresponding Cancer Risk equals 95% UCL divided by the RSL divided by the acceptable risk level.^c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.^d Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05,

Constituents selected as COPCs are indicated by shading.

ug/L = micrograms per liter

HI = Hazard Index

ProUCL, Version 4.00.05 used to determine distribution of data and calculate 95% UCL, following recommendations

in users guide (USEPA. May 2010. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

Options: 95% Kaplan-Meier (t) UCL (95% KM-t)

UCL Rationale:

(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.

(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.

(3) Test indicates data are gamma distributed.

(4) Distribution tests are inconclusive

(5) Maximum value used because calculated 95% UCL exceeds maximum concentration.

TABLE 2.3

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site UXO-02

MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Sediment UXO-02	121-14-2	2,4-Dinitrotoluene	ND	ND	MG/KG	MR02-SD06-10A	0/10	0.63 - 3.4	3.4E+00	N/A	1.6E+00 C*	N/A	N/A	YES	DLASL
	606-20-2	2,6-Dinitrotoluene	ND	ND	MG/KG		0/10	0.63 - 3.4	3.4E+00	N/A	6.1E+00 N	N/A	N/A	NO	DLBSL
	98-95-3	Nitrobenzene	ND	ND	MG/KG		0/10	0.63 - 3.4	3.4E+00	N/A	4.8E+00 C*	N/A	N/A	NO	DLBSL
	99-35-4	1,3,5-Trinitrobenzene	ND	ND	MG/KG		0/10	0.63 - 3.4	3.4E+00	N/A	2.2E+02 N	N/A	N/A	NO	DLBSL
	99-65-0	1,3-Dinitrobenzene	ND	ND	MG/KG		0/10	0.63 - 3.4	3.4E+00	N/A	6.1E-01 N	N/A	N/A	YES	DLASL
	118-96-7	2,4,6-Trinitrotoluene	ND	ND	MG/KG		0/10	0.63 - 3.4	3.4E+00	N/A	3.6E+00 C**	N/A	N/A	NO	DLBSL
	35572-78-2	2-Amino-4,6-dinitrotoluene	ND	ND	MG/KG		0/10	0.63 - 3.4	3.4E+00	N/A	1.5E+01 N	N/A	N/A	NO	DLBSL
	88-72-2	2-Nitrotoluene	ND	ND	MG/KG		0/10	0.63 - 3.4	3.4E+00	N/A	2.9E+00 C*	N/A	N/A	YES	DLASL
	99-08-1	3-Nitrotoluene	ND	ND	MG/KG		0/10	0.63 - 3.4	3.4E+00	N/A	6.1E-01 N	N/A	N/A	YES	DLASL
	19406-51-0	4-Amino-2,6-dinitrotoluene	ND	ND	MG/KG		0/10	0.63 - 3.4	3.4E+00	N/A	1.5E+01 N	N/A	N/A	NO	DLBSL
	99-99-0	4-Nitrotoluene	ND	ND	MG/KG		0/10	0.63 - 3.4	3.4E+00	N/A	2.4E+01 C**	N/A	N/A	NO	DLBSL
	2691-41-0	HMX	ND	ND	MG/KG		0/10	0.63 - 3.4	3.4E+00	N/A	3.8E+02 N	N/A	N/A	NO	DLBSL
	55-63-0	Nitroglycerin	ND	ND	MG/KG		0/10	1 - 5.4	5.4E+00	N/A	6.1E-01 N	N/A	N/A	YES	DLASL
	14797-73-0	Perchlorate	2.8E-03	1.9E-02	MG/KG		10/10	0.0028 - 0.019	1.9E-02	N/A	5.5E+00 N	N/A	N/A	NO	BSL
	78-11-5	PETN	ND	ND	MG/KG		0/10	1.9 - 10	1.0E+01	N/A	N/A	N/A	N/A	NO	NTX
	121-82-4	RDX	ND	ND	MG/KG		0/10	0.63 - 3.4	3.4E+00	N/A	5.5E+00 C*	N/A	N/A	NO	DLBSL
	479-45-8	Tetryl	ND	ND	MG/KG		0/10	0.63 - 3.4	3.4E+00	N/A	2.4E+01 N	N/A	N/A	NO	DLBSL
	7429-90-5	Aluminum	2.4E+03	3.1E+04	MG/KG	MR02-SD01-10A	10/10	42 - 270	3.1E+04	N/A	7.7E+03 N	N/A	N/A	YES	ASL
	7440-36-0	Antimony	ND	ND	MG/KG	MR02-SD01-10A	0/10	2.1 - 14	1.4E+01	N/A	3.1E+00 N	N/A	N/A	YES	DLASL
	7440-38-2	Arsenic	4.9E-01 J	5.8E+00	MG/KG		10/10	0.53 - 3.4	5.8E+00	N/A	3.9E-01 C*	N/A	N/A	YES	ASL
	7440-39-3	Barium	ND	ND	MG/KG		0/10	42 - 270	2.7E+02	N/A	1.5E+03 N	N/A	N/A	NO	DLBSL
	7440-41-7	Beryllium	3.0E-02 J	1.1E+00 J	MG/KG	MR02-SD06-10A	10/10	1 - 6.9	1.1E+00	N/A	1.6E+01 N	N/A	N/A	NO	BSL
	7440-43-9	Cadmium	ND	ND	MG/KG	MR02-SD03-10A	0/10	0.74 - 4.8	4.8E+00	N/A	7.0E+00 N	N/A	N/A	NO	DLBSL
	7440-70-2	Calcium	3.1E+03	7.2E+03	MG/KG		4/10	1000 - 6900	7.2E+03	N/A	N/A	N/A	N/A	NO	NUT
	7440-47-3	Chromium	3.4E+00	4.0E+01	MG/KG	MR02-SD01-10A	7/10	2.1 - 14	4.0E+01	N/A	2.9E-01 C	N/A	N/A	YES	ASL
	7440-48-4	Cobalt	3.6E-01 J	2.0E+00 J	MG/KG	MR02-SD03-10A	7/10	10 - 69	2.0E+00	N/A	2.3E+00 N	N/A	N/A	NO	BSL
	7440-50-8	Copper	ND	ND	MG/KG	MR02-SD01-10A	0/10	5.3 - 34	3.4E+01	N/A	3.1E+02 N	N/A	N/A	NO	DLBSL
	7439-89-6	Iron	1.2E+03	1.7E+04	MG/KG		10/10	21 - 140	1.7E+04	N/A	5.5E+03 N	N/A	N/A	YES	ASL
	7439-92-1	Lead	3.5E+00	2.5E+01	MG/KG	MR02-SD04-10A	10/10	0.63 - 4.1	2.5E+01	N/A	4.0E+02 N	N/A	N/A	NO	BSL
	7439-95-4	Magnesium	4.2E+03	7.9E+03	MG/KG	MR02-SD03-10A	4/10	1000 - 6900	7.9E+03	N/A	N/A	N/A	N/A	NO	NUT
	7439-96-5	Manganese	1.4E+01 J	8.0E+01 J	MG/KG	MR02-SD05D-10A	10/10	3.2 - 21	8.0E+01	N/A	1.8E+02 N	N/A	N/A	NO	BSL
	7439-97-6	Mercury	ND	ND	MG/KG	MR02-SD06-10A	0/10	0.15 - 1	1.0E+00	N/A	2.3E+00 N	N/A	N/A	NO	DLBSL
	7440-02-0	Nickel	ND	ND	MG/KG		0/10	8.4 - 55	5.5E+01	N/A	1.5E+02 N	N/A	N/A	NO	DLBSL
	7440-09-7	Potassium	ND	ND	MG/KG		0/10	1000 - 6900	6.9E+03	N/A	N/A	N/A	N/A	NO	NUT
	7782-49-2	Selenium	ND	ND	MG/KG		0/10	1 - 6.9	6.9E+00	N/A	3.9E+01 N	N/A	N/A	NO	DLBSL
	7440-22-4	Silver	ND	ND	MG/KG		0/10	2.1 - 14	1.4E+01	N/A	3.9E+01 N	N/A	N/A	NO	DLBSL

TABLE 2.3

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site UXO-02

MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	7440-23-5	Sodium	3.5E+03	1.9E+04	MG/KG	MR02-SD05D-10A	5/10	1000 - 6900	1.9E+04	N/A	N/A	N/A	N/A	NO	NUT
	7440-28-0	Thallium	ND	ND	MG/KG		0/10	0.53 - 3.4	3.4E+00	N/A	N/A	N/A	N/A	NO	NTX
	7440-62-2	Vanadium	3.7E+00 J	4.8E+01	MG/KG	MR02-SD01-10A	10/10	10 - 69	4.8E+01	N/A	3.9E+01 N	N/A	N/A	YES	ASL
	7440-66-6	Zinc	1.5E+01	4.9E+01	MG/KG	MR02-SD05D-10A	9/10	4.2 - 27	4.9E+01	N/A	2.3E+03 N	N/A	N/A	NO	BSL

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values not available.

[4] Oak Ridge National Laboratory (ORNL). May 2010. Residential Soil Regional Screening Levels for Chemical Contaminants at Superfund Sites (based on 10-6 for carcinogens and HQ of 0.1 for noncarcinogens). [Online]. Available: <http://epa-prgs.ornl.gov/chemicals/index.shtml>

RSL value for Chromium(VI) used as surrogate for chromium.

The soil value of 400 mg/kg for lead is from the Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, USEPA, July 14, 1994.

RSL value for Manganese (water) used as surrogate for manganese.

RSL value for Mercury (inorganic salts) used as surrogate for mercury.

[5] Rationale Codes

Selection Reason:	Above Screening Levels (ASL)
	Detection Limit Above Screening Level (DLASL), not quantitatively evaluated in HHRA but discussed in uncertainty assessment
Deletion Reason:	Below Screening Level (BSL)
	Detection Limit Below Screening Level (DLBSL)
	No Toxicity Information (NTX)
	Essential Nutrient (NUT)

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

C* = N screening level < 100x C screening level

C** = N screening level < 10x C screening level, therefore

N screening value/10 used as screening level

S = RSL concentration exceeds Csat, used Csat as screening value

N/A = Not available

ND = Not Detected

NL = Noncarcinogenic lead residential soil RSL not adjusted by dividing by 10.

mg/kg = milligram per kilogram

TABLE 2.3a

Risk Ratio Screening for Sediment, Maximum Detected Concentration

Site UXO-02

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample	Residential Soil RSL	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Risk ^b	Target Organ
Metals (mg/kg)								
Aluminum	10 / 10	3.1E+04	MR02-SD01-10A	7.7E+04	1	0.4	NA	Neurological, Developmental
Arsenic	10 / 10	5.8E+00	MR02-SD01-10A	3.9E-01	1.E-06	NA	1.E-05	NA
Chromium	7 / 10	4.0E+01	MR02-SD01-10A	2.9E-01	1.E-06	NA	1.E-04	NA
Iron	10 / 10	1.7E+04	MR02-SD01-10A	5.5E+04	1	0.3	NA	Gastrointestinal
Vanadium	10 / 10	4.8E+01	MR02-SD01-10A	3.9E+02	1	0.1	NA	Hair, Blood
Cumulative Corresponding Hazard Index^c						0.8		
Cumulative Corresponding Cancer Risk^d							1.E-04	
Total Neurological HI =								0.4
Total Developmental HI =								0.4
Total Gastrointestinal HI =								0.3
Total Hair HI =								0.1
Total Blood HI =								0.1

^a Corresponding Hazard Index equals maximum detected concentration divided by the SL divided by the acceptable risk level.^b Corresponding Cancer Risk equals maximum detected concentration divided by the SL divided by the acceptable risk level.^c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.^d Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05, otherwise, constituent not selected as COPC.

Constituents selected as COPCs are indicated by shading.

COPC = Constituent of Potential Concern

HI = Hazard Index

mg/kg = milligrams per kilogram

RSL = Oak Ridge National Laboratory (ORNL). May 2010. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. [Online].

Available: <http://epa-prgs.ornl.gov/chemicals/index.shtml>

TABLE 2.3b

Risk Ratio Screening for Sediment, 95% UCL Concentration

Site UXO-02

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	95% UCL		95% UCL Rationale	Screening Level	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Risk ^b	Target Organ
Metals (mg/kg)									
Arsenic	10 / 10	3.6E+00	95% Stud-t	1, 2, 3	3.9E-01	1.E-06	NA	9.E-06	NA
Chromium	7 / 10	2.4E+01	95% KM-t	1, 2, 3	2.9E-01	1.E-06	NA	8.E-05	NA
Cumulative Corresponding Hazard Index ^c							NA		
Cumulative Corresponding Cancer Risk ^d								9E-05	

^a Corresponding Hazard Index equals 95% UCL divided by the RSL divided by the acceptable risk level.^b Corresponding Cancer Risk equals 95% UCL divided by the RSL divided by the acceptable risk level.^c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.^d Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05,

Constituents selected as COPCs are indicated by shading.

mg/kg = milligrams per kilogram

HI = Hazard Index

ProUCL, Version 4.00.05 used to determine distribution of data and calculate 95% UCL, following recommendations

in users guide (USEPA, May 2010. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

Options: 95% Student's-T test UCL (95% Stud-t); 95% Kaplan-Meier (t) UCL (95% KM-t)

UCL Rationale:

- (1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
- (2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
- (3) Test indicates data are gamma distributed.
- (4) Distribution tests are inconclusive
- (5) Maximum value used because calculated 95% UCL exceeds maximum concentration.

TABLE 2.4

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site UXO-2

MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Groundwater UXO-02	121-14-2	2,4-Dinitrotoluene	ND	ND	UG/L		0/35	0.26 - 0.26	2.6E-01	N/A	2.2E-01 C	N/A	N/A	YES	DLASL
	606-20-2	2,6-Dinitrotoluene	ND	ND	UG/L		0/35	0.26 - 0.26	2.6E-01	N/A	3.7E+00 N	N/A	N/A	NO	DLBSL
	98-95-3	Nitrobenzene	ND	ND	UG/L		0/35	0.26 - 0.26	2.6E-01	N/A	1.2E-01 C	N/A	N/A	YES	DLASL
	99-35-4	1,3,5-Trinitrobenzene	ND	ND	UG/L		0/35	0.26 - 0.26	2.6E-01	N/A	1.1E+02 N	N/A	N/A	NO	DLBSL
	99-65-0	1,3-Dinitrobenzene	ND	ND	UG/L		0/35	0.26 - 0.26	2.6E-01	N/A	3.7E-01 N	N/A	N/A	NO	DLBSL
	118-96-7	2,4,6-Trinitrotoluene	ND	ND	UG/L		0/35	0.26 - 0.26	2.6E-01	N/A	1.8E+00 C**	N/A	N/A	NO	DLBSL
	35572-78-2	2-Amino-4,6-dinitrotoluene	ND	ND	UG/L		0/35	0.26 - 0.26	2.6E-01	N/A	7.3E+00 N	N/A	N/A	NO	DLBSL
	88-72-2	2-Nitrotoluene	ND	ND	UG/L		0/35	0.52 - 0.52	5.2E-01	N/A	3.1E-01 C	N/A	N/A	YES	DLASL
	99-08-1	3-Nitrotoluene	ND	ND	UG/L		0/35	0.52 - 0.52	5.2E-01	N/A	3.7E-01 N	N/A	N/A	YES	DLASL
	19406-51-0	4-Amino-2,6-dinitrotoluene	ND	ND	UG/L		0/35	0.26 - 0.26	2.6E-01	N/A	7.3E+00 N	N/A	N/A	NO	DLBSL
	99-99-0	4-Nitrotoluene	ND	ND	UG/L		0/35	0.52 - 0.52	5.2E-01	N/A	4.2E+00 C*	N/A	N/A	NO	DLBSL
	2691-41-0	HMX	ND	ND	UG/L		0/35	0.52 - 0.52	5.2E-01	N/A	1.8E+02 N	N/A	N/A	NO	DLBSL
	55-63-0	Nitroglycerin	ND	ND	UG/L		0/35	2 - 2	2.0E+00	N/A	3.7E-01 N	N/A	N/A	YES	DLASL
	14797-73-0	Perchlorate	ND	ND	UG/L		0/35	0.5 - 0.5	5.0E-01	N/A	2.6E+00 N	N/A	N/A	NO	DLBSL
	78-11-5	PETN	ND	ND	UG/L		0/35	4.5 - 4.5	4.5E+00	N/A	N/A	N/A	N/A	NO	NTX
	121-82-4	RDX	ND	ND	UG/L		0/35	0.52 - 0.52	5.2E-01	N/A	6.1E-01 C	N/A	N/A	NO	DLBSL
	479-45-8	Tetryl	ND	ND	UG/L		0/35	0.52 - 0.52	5.2E-01	N/A	1.5E+01 N	N/A	N/A	NO	DLBSL
	7429-90-5	Aluminum	6.5E+01 J	5.5E+04 J	UG/L	MR02-GW17-10A	33/35	200 - 200	5.5E+04	1.9E+03	3.7E+03 N	50 - 200	SMCL	YES	ASL
	7440-36-0	Antimony	2.0E+00 J	7.0E+00 J	UG/L	MR02-GW08-10A	2/35	10 - 10	7.0E+00	3.3E+00	1.5E+00 N	6.0E+00	MCL	YES	ASL
	7440-38-2	Arsenic	2.0E+00 J	9.3E+00 J	UG/L	MR02-GW12-10A	8/35	10 - 10	9.3E+00	5.8E+00	4.5E-02 C	1.0E+01	MCL	YES	ASL
												1.0E+01	15A NCAC 2L		
	7440-39-3	Barium	8.5E+00 J	2.1E+02	UG/L	MR02-GW06-10A	27/35	200 - 200	2.1E+02	8.6E+01	7.3E+02 N	2.0E+03	MCL	NO	BSL
												7.0E+02	15A NCAC 2L		
	7440-41-7	Beryllium	ND	ND	UG/L		0/35	5 - 5	5.0E+00	3.1E-01	7.3E+00 N	4.0E+00	MCL	NO	DLBSL
	7440-43-9	Cadmium	ND	ND	UG/L		0/35	1 - 1	1.0E+00	3.6E-01	1.8E+00 N	5.0E+00	MCL	NO	DLBSL
												2.0E+00	15A NCAC 2L		
	7440-70-2	Calcium	5.2E+03	6.3E+04	UG/L	MR02-IR69-GW15-10A	13/35	5000 - 5000	6.3E+04	6.9E+04	N/A	N/A	N/A	NO	NUT
	7440-47-3	Chromium	6.2E-01 J	5.7E+01	UG/L	MR02-GW17-10A	12/35	10 - 10	5.7E+01	3.1E+00	4.3E-02 C	1.0E+02	MCL	YES	ASL
												1.0E+01	15A NCAC 2L		
	7440-48-4	Cobalt	2.9E-01 J	1.0E+01 J	UG/L	MR02-GW12-10A	12/35	50 - 50	1.0E+01	3.4E+00	1.1E+00 N	N/A	N/A	YES	ASL
	7440-50-8	Copper	5.7E+00 J	4.8E+01	UG/L	MR02-GW06-10A	4/35	25 - 25	4.8E+01	2.8E+00	1.5E+02 N	1.3E+03	MCL	NO	BSL
												1.0E+03	15A NCAC 2L		
	7439-89-6	Iron	1.1E+02 J	3.1E+04	UG/L	MR02-IR69-GW15-10A	34/35	100 - 100	3.1E+04	6.0E+03	2.6E+03 N	3.0E+02	15A NCAC 2L	YES	ASL
	7439-92-1	Lead	8.1E-01 J	2.4E+01	UG/L	MR02-GW06-10A	21/35	3 - 3	2.4E+01	2.8E+00	1.5E+01	1.5E+01	MCL, 15A NCAC 2L	YES	ASL
	7439-95-4	Magnesium	7.7E+03	8.4E+03 J	UG/L	MR02-GW09-10A	2/35	5000 - 5000	8.4E+03	6.4E+03	N/A	N/A	N/A	NO	NUT
	7439-96-5	Manganese	5.0E+00 J	8.0E+02	UG/L	MR02-IR69-GW15-10A	31/35	15 - 15	8.0E+02	2.1E+02	8.8E+01 N	5.0E+01	15A NCAC 2L	YES	ASL
	7439-97-6	Mercury	4.0E-02 J	8.0E-02 J	UG/L	MR02-GW06-10A	2/35	0.2 - 0.2	8.0E-02	1.0E-01	1.1E+00 N	2.0E+00	MCL	NO	BSL
												1.0E+00	15A NCAC 2L		
	7440-02-0	Nickel	4.6E-01 J	2.5E+01 J	UG/L	MR02-GW25-10A	27/35	40 - 40	2.5E+01	8.0E+00	7.3E+01 N	1.0E+02	15A NCAC 2L	NO	BSL

TABLE 2.4

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site UXO-2

MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	7440-09-7	Potassium	2.0E+02 J	9.0E+03	UG/L	MR02-GW08-10A	32/35	5000 - 5000	9.0E+03	3.3E+03	N/A	N/A	N/A	NO	NUT
	7782-49-2	Selenium	5.6E-01 J	1.3E+00 J	UG/L	MR02-GW08-10A : MR02-GW24-10A	7/35	5 - 5	1.3E+00	3.1E+00	1.8E+01 N	5.0E+01 2.0E+01	MCL, 15A 15A NCAC 2L	NO	BSL
	7440-22-4	Silver	ND	ND	UG/L		0/35	10 - 10	1.0E+01	7.7E-01	1.8E+01 N	2.0E+01	15A NCAC 2L	NO	DLBSL
	7440-23-5	Sodium	5.3E+03	7.5E+04	UG/L	MR02-GW09-10A	31/35	5000 - 5000	7.5E+04	2.3E+04	N/A	N/A	N/A	NO	NUT
	7440-28-0	Thallium	6.0E-02 J	4.1E-01 J	UG/L	MR02-GW06-10A	9/35	2 - 2	4.1E-01	3.8E+00	N/A	2.0E+00	MCL	NO	NTX
	7440-62-2	Vanadium	3.8E-01 J	5.5E+01	UG/L	MR02-GW17-10A	28/35	50 - 50	5.5E+01	4.7E+00	1.8E+01 N	N/A	N/A	YES	ASL
	7440-66-6	Zinc	2.8E+01	4.2E+02	UG/L	MR02-GW16-10A	15/35	20 - 20	4.2E+02	4.2E+01	1.1E+03 N	1.0E+03	15A NCAC 2L	NO	BSL

[1] Minimum/Maximum detected concentration. Unfiltered results for metals since in general no significant difference between filtered and unfiltered results.

[2] Maximum concentration is used for screening.

[3] Background values not available.

[4] Oak Ridge National Laboratory (ORNL), May, 2010. Regional Screening Levels for Chemical Contaminants at Superfund Sites.
Available: <http://epa-prgs.ornl.gov/chemicals/index.shtml>. Adjusted (noncarcinogenic RSLs adjusted by dividing by 10) tap water RSLs.

RSL value for Chromium(VI) used as surrogate for chromium.

RSL value for Manganese (water) used as surrogate for manganese.

RSL value for Mercury (inorganic salts) used as surrogate for mercury.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Detection Limit Above Screening Level (DLASL), not quantitatively evaluated in HHRA
Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Below Background (BBK)
Detection Limit Below Screening Level (DLBSL)

MCL = Maximum Contaminant Level from EPA's National Primary Drinking Water Standards

SMCL = Secondary Maximum Contaminant Level from EPA's National Primary Drinking Water Standards.

15A NCAC 2L = North Carolina Classifications and Groundwater Quality Standards,
Amended January 2010.

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
To Be Considered

J = Estimated Value

C = Carcinogenic

N = Noncarcinogenic

ND = Not detected

ug/L = micrograms per liter

C* = N screening level < 100x C screening level

C** = N screening level < 10x C screening level, therefore

N screening value/10 used as screening level

N/A = Not available

TABLE 2.4a

Risk Ratio Screening for Groundwater, Maximum Detected Concentration

Site UXO-2

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample Location of Maximum Detected Concentration	Tap Water RSL	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Risk ^b	Target Organ
Metals (ug/L)								
Aluminum	33 / 35	5.5E+04 J	MR02-GW17-10A	3.7E+04	1	1.5	NA	Neurological, Developmental
Antimony	2 / 35	7.0E+00 J	MR02-GW08-10A	1.5E+01	1	0.5	NA	Longevity, Blood
Arsenic	8 / 35	9.3E+00 J	MR02-GW12-10A	4.5E-02	1.E-06	NA	2.E-04	NA
Chromium	12 / 35	5.7E+01	MR02-GW17-10A	4.3E-02	1.E-06	NA	1.E-03	NA
Cobalt	12 / 35	1.0E+01 J	MR02-GW12-10A	1.1E+01	1	0.9	NA	Thyroid
Iron	34 / 35	3.1E+04	MR02-IR69-GW15-10A	2.6E+04	1	1.2	NA	Gastrointestinal
Manganese	31 / 35	8.0E+02	MR02-IR69-GW15-10A	8.8E+02	1	0.9	NA	CNS
Vanadium	28 / 35	5.5E+01	MR02-GW17-10A	1.8E+02	1	0.3	NA	Hair, Blood
Cumulative Corresponding Hazard Index ^c						5.3		
Cumulative Corresponding Cancer Risk ^d							2E-03	

Notes:

a Corresponding Hazard Index equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

b Corresponding Cancer Risk equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.

d Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05, otherwise, constituent not selected as COPC.

Constituents selected as COPCs are indicated by shading.

COPC = Constituent of Potential Concern

HI = Hazard Index

ug/L = micrograms per liter

NA = Not available/not applicable.

CNS = Central Nervous System

Total Neurological HI =	2.4
Total Developmental HI =	1.5
Total Longevity HI =	0.5
Total Gastrointestinal HI =	1.2
Total Hair HI =	0.3
Total Blood HI =	0.8
Total Thyroid HI =	0.9

TABLE 2.4b

Risk Ratio Screening for Groundwater, 95% UCL Concentration

Site UXO-02

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	95% UCL		95% UCL Rationale	Screening Level	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Risk ^b	Target Organ
Metals (ug/L)									
Aluminum	33 / 35	2.6E+04	99% KM	1	3.7E+04	1	0.7	NA	Neurological, Developmental
Antimony	2 / 35	7.0E+00	Max	4	1.5E+01	1	0.5	NA	Longevity, Blood
Arsenic	8 / 35	6.3E+00	95% KM-t	1, 2, 3	4.5E-02	1.E-06	NA	1.E-04	NA
Chromium	12 / 35	1.1E+01	95%KM-t	1, 3	4.3E-02	1.E-06	NA	2.E-04	NA
Cobalt	12 / 35	3.4E+00	95%KM-t	1, 3	1.1E+01	1	0.3	NA	Thyroid
Iron	34 / 35	1.6E+04	99%KM	1	2.6E+04	1	0.6	NA	Gastrointestinal
Manganese	31 / 35	2.2E+02	97.5% KM	1	8.8E+02	1	0.3	NA	CNS
Vanadium	28 / 35	2.5E+01	97.5% KM	4	1.8E+02	1	0.1	NA	Hair, Blood
Cumulative Corresponding Hazard Index ^c							NA		
Cumulative Corresponding Cancer Risk ^d								4E-04	
Total Neurological HI =								1.0	
Total Developmental HI =								0.7	
Total Longevity HI =								0.5	
Total Gastrointestinal HI =								0.6	
Total Hair HI =								0.1	
Total Blood HI =								0.6	
Total Thyroid HI =								0.3	

^a Corresponding Hazard Index equals 95% UCL divided by the RSL divided by the acceptable risk level.

^b Corresponding Cancer Risk equals 95% UCL divided by the RSL divided by the acceptable risk level.

^c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.

^a Corresponding Hazard Index equals 95% UCL divided by the RSL divided by the acceptable risk level.^b Corresponding Cancer Risk equals 95% UCL divided by the RSL divided by the acceptable risk level.^c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.^d Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05,

Constituents selected as COPCs are indicated by shading.

ug/L = micrograms per liter

CNS = Central Nervous System

HI = Hazard Index

ProUCL, Version 4.00.05 used to determine distribution of data and calculate 95% UCL, following recommendations

in users guide (USEPA. May 2010. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

Options: 95% Kaplan-Meier Chebyshev UCL (95% KM); 95% Kaplan-Meier (t) UCL (95% KM-t); 97.5% Kaplan-Meier Chebyshev UCL (97.5% KM); 99% Kaplan-Meier Chebyshev UCL (99% KM);

Maximum detected concentration (Max)

UCL Rationale:

- (1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
- (2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
- (3) Test indicates data are gamma distributed.
- (4) Distribution tests are inconclusive
- (5) Maximum value used because calculated 95% UCL exceeds maximum concentration.

TABLE 2.5

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site UXO-2

MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Subsurface Soil UXO-02	121-14-2	2,4-Dinitrotoluene	ND	ND	MG/KG		0/28	0.45 - 0.69	6.9E-01	N/A	1.6E+00 C*	N/A		NO	DLBSL
	606-20-2	2,6-Dinitrotoluene	ND	ND	MG/KG		0/28	0.45 - 0.69	6.9E-01	N/A	6.1E+00 N	N/A		NO	DLBSL
	98-95-3	Nitrobenzene	ND	ND	MG/KG		0/28	0.45 - 0.69	6.9E-01	N/A	4.8E+00 C*	N/A		NO	DLBSL
	99-35-4	1,3,5-Trinitrobenzene	ND	ND	MG/KG		0/28	0.45 - 0.69	6.9E-01	N/A	2.2E+02 N	N/A		NO	DLBSL
	99-65-0	1,3-Dinitrobenzene	ND	ND	MG/KG		0/28	0.45 - 0.69	6.9E-01	N/A	6.1E-01 N	N/A		YES	DLASL
	118-96-7	2,4,6-Trinitrotoluene	ND	ND	MG/KG		0/28	0.45 - 0.69	6.9E-01	N/A	3.6E+00 C**	N/A		NO	DLBSL
	35572-78-2	2-Amino-4,6-dinitrotoluene	ND	ND	MG/KG		0/28	0.45 - 0.69	6.9E-01	N/A	1.5E+01 N	N/A		NO	DLBSL
	88-72-2	2-Nitrotoluene	ND	ND	MG/KG		0/28	0.45 - 0.69	6.9E-01	N/A	2.9E+00 C*	N/A		NO	DLBSL
	99-08-1	3-Nitrotoluene	ND	ND	MG/KG		0/28	0.45 - 0.69	6.9E-01	N/A	6.1E-01 N	N/A		YES	DLASL
	19406-51-0	4-Amino-2,6-dinitrotoluene	ND	ND	MG/KG		0/28	0.45 - 0.69	6.9E-01	N/A	1.5E+01 N	N/A		NO	DLBSL
	99-99-0	4-Nitrotoluene	ND	ND	MG/KG		0/28	0.45 - 0.69	6.9E-01	N/A	2.4E+01 C**	N/A		NO	DLBSL
	2691-41-0	HMX	ND	ND	MG/KG		0/28	0.45 - 0.69	6.9E-01	N/A	3.8E+02 N	N/A		NO	DLBSL
	55-63-0	Nitroglycerin	ND	ND	MG/KG		0/28	0.72 - 1.1	1.1E+00	N/A	6.1E-01 N	N/A		YES	DLASL
	14797-73-0	Perchlorate	ND	ND	MG/KG		0/28	0.0021 - 0.0027	2.7E-03	N/A	5.5E+00 N	N/A		NO	DLBSL
	78-11-5	PETN	ND	ND	MG/KG		0/28	1.4 - 2	2.0E+00	N/A	N/A	N/A		NO	NTX
	121-82-4	RDX	ND	ND	MG/KG		0/28	0.45 - 0.69	6.9E-01	N/A	5.5E+00 C*	N/A		NO	DLBSL
	479-45-8	Tetryl	ND	ND	MG/KG		0/28	0.45 - 0.69	6.9E-01	N/A	2.4E+01 N	N/A		NO	DLBSL
	7429-90-5	Aluminum	3.9E+01	2.4E+04	MG/KG	MR02-IS02-5-6-10A	28/28	28 - 49	2.4E+04	1.0E+04	7.7E+03 N	N/A		YES	ASL
	7440-36-0	Antimony	1.0E-01 J	1.0E-01 J	MG/KG	MR02-IS29-4-5-10A	1/28	1.4 - 2.5	1.0E-01	3.6E+01	3.1E+00 N	N/A		NO	BSL
	7440-38-2	Arsenic	1.2E-01 J	5.5E+00	MG/KG	MR02-IS02-5-6-10A : MR02-IS17-5-6-10A	17/28	0.35 - 0.62	5.5E+00	2.1E+00	3.9E-01 C*	5.8E+00	NCSSL	YES	ASL
	7440-39-3	Barium	1.4E+00 J	3.0E+01 J	MG/KG	MR02-IS08-4-5-10A	23/28	28 - 49	3.0E+01	1.7E+01	1.5E+03 N	5.8E+02	NCSSL	NO	BSL
	7440-41-7	Beryllium	ND	ND	MG/KG		0/28	0.71 - 1.2	1.2E+00	1.7E-01	1.6E+01 N	N/A		NO	DLBSL
	7440-43-9	Cadmium	8.0E-02 J	8.0E-02 J	MG/KG	MR02-IS17-5-6-10A	1/28	0.49 - 0.87	8.0E-02	2.3E-02	7.0E+00 N	3.0E+00	NCSSL	NO	BSL
	7440-70-2	Calcium	ND	ND	MG/KG		0/28	690 - 1200	1.2E+03	4.4E+02	N/A	N/A		NO	NUT
	7440-47-3	Chromium	2.0E+00	3.5E+01	MG/KG	MR02-IS17-5-6-10A	20/28	1.4 - 2.5	3.5E+01	8.2E-01	2.9E-01 C	3.8E+00	NCSSL	YES	ASL
	7440-48-4	Cobalt	4.0E-02 J	1.3E+00 J	MG/KG	MR02-IS17-5-6-10A	10/28	7.1 - 12	1.3E+00	2.6E+00	2.3E+00 N	N/A		NO	BSL
	7440-50-8	Copper	5.7E+00	6.3E+00	MG/KG	MR02-IS17-5-6-10A	2/28	3.4 - 6.2	6.3E+00	1.7E+01	3.1E+02 N	7.0E+02	NCSSL	NO	BSL
	7439-89-6	Iron	5.2E+01	1.8E+04 J	MG/KG	MR02-IS17-5-6-10A	28/28	14 - 25	1.8E+04	5.4E+03	5.5E+03 N	1.5E+02	NCSSL	YES	ASL
	7439-92-1	Lead	3.0E-01 J	9.6E+00	MG/KG	MR02-IS17-5-6-10A	28/28	0.42 - 0.74	9.6E+00	8.5E+00	4.0E+02 N	2.7E+02	NCSSL	NO	BSL
	7439-95-4	Magnesium	1.2E+03 J	1.3E+03 J	MG/KG	MR02-IS01-6-7-10A	4/28	690 - 1200	1.3E+03	3.6E+02	N/A	N/A		NO	NUT
	7439-96-5	Manganese	2.4E+00 J	2.9E+01	MG/KG	MR02-IS21D-5-6-10A	27/28	2.1 - 3.7	2.9E+01	9.3E+00	1.8E+02 N	6.5E+01	NCSSL	NO	BSL
	7439-97-6	Mercury	1.0E-02 J	4.0E-02 J	MG/KG	MR02-IS13-2-3-10A	9/28	0.13 - 0.22	4.0E-02	7.1E-02	2.3E+00 N	1.0E+00	NCSSL	NO	BSL
	7440-02-0	Nickel	1.1E-01 J	4.0E+00 J	MG/KG	MR02-IS17-5-6-10A	11/28	5.6 - 9.9	4.0E+00	2.3E+00	1.5E+02 N	1.3E+02	NCSSL	NO	BSL
	7440-09-7	Potassium	4.6E+01 J	1.6E+03 J	MG/KG	MR02-IS17-5-6-10A	16/28	710 - 1200	1.6E+03	3.6E+02	N/A	N/A		NO	NUT
	7782-49-2	Selenium	5.0E-02 J	5.5E-01 J	MG/KG	MR02-IS17-5-6-10A	20/28	0.71 - 1.2	5.5E-01	5.1E-01	3.9E+01 N	2.1E+00	NCSSL	NO	BSL
	7440-22-4	Silver	4.0E-02 J	1.0E-01 J	MG/KG	MR02-IS17-5-6-10A	3/28	1.4 - 2.5	1.0E-01	1.3E-01	3.9E+01 N	3.4E+00	NCSSL	NO	BSL

TABLE 2.5

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Site UXO-2

MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	7440-23-5	Sodium	ND	ND	MG/KG		0/28	710 - 1200	1.2E+03	6.8E+01	N/A	N/A		NO	NUT
	7440-28-0	Thallium	1.0E-02 J	1.7E-01 J	MG/KG	MR02-IS02-5-6-10A	20/28	0.35 - 0.62	1.7E-01	3.8E-01	N/A	N/A		NO	NTX
	7440-62-2	Vanadium	2.1E-01 J	4.6E+01	MG/KG	MR02-IS17-5-6-10A	13/28	7.1 - 12	4.6E+01	1.7E+01	3.9E+01 N	N/A		YES	ASL
	7440-66-6	Zinc	3.7E+00	2.4E+01	MG/KG	MR02-IS17-5-6-10A	9/28	2.8 - 4.9	2.4E+01	6.6E+00	2.3E+03 N	1.2E+03	NCSSL	NO	BSL

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening. If ND, maximum detection limit used for screening.

[3] Background values are two times the arithmetic mean basewide background subsurface soil concentrations.

Background values are from *Final Base Background Soil Study Report, Marine Corps Base Camp Lejeune, North Carolina*, Baker Environmental, April 25, 2001.

[4] Oak Ridge National Laboratory (ORNL). May, 2010. Regional Screening Levels for Chemical Contaminants at Superfund Sites. [Online].

Available: <http://epa-prgs.ornl.gov/chemicals/index.shtml>. Adjusted (noncarcinogenic RSLs adjusted by dividing by 10) residential soil RSLs.

RSL value for Chromium(VI) used as surrogate for chromium.

The soil value of 400 mg/kg for lead is from the Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action

Facilities, USEPA, July 14, 1994.

RSL value for Manganese (water) used as surrogate for manganese.

RSL value for Mercury (inorganic salts) used as surrogate for mercury.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Detection Limit Above Screening Level (DLASL), not quantitatively evaluated in HHRA

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Below Background (BBK)
Detection Limit Below Screening Level (DLBSL)

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
To Be Considered

NCSSL = North Carolina Soil Screening Levels (NCDENR, 2010)

J = Estimated Value

N/A = Not Applicable/Not Available

ND = Not Detected

NL = Noncarcinogenic lead residential soil RSL not adjusted by dividing by 10.

C = Carcinogenic

N = Noncarcinogenic

C* = N screening level < 100x C screening level

C** = N screening level < 10x C screening level, therefore

N screening value/10 used as screening level

S or NS = concentration exceeds Csat, used Csat as screening value

TABLE 2.5a

Risk Ratio Screening for Subsurface Soil, Maximum Detected Concentration

Site UXO-2

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample Location of Maximum Detected Concentration	Residential Soil RSL	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Risk ^b	Target Organ
Metals (mg/kg)								
Aluminum	28 / 28	2.4E+04	MR02-IS02-5-6-10A	7.7E+04	1	0.3	NA	Neurological, Developmental
Arsenic	17 / 28	5.5E+00	MR02-IS02-5-6-10A : MR02-IS17-5-6-10A	3.9E-01	1E-06	NA	1E-05	NA
Chromium	20 / 28	3.5E+01	MR02-IS17-5-6-10A	2.9E-01	1E-06	NA	1E-04	NA
Iron	28 / 28	1.8E+04 J	MR02-IS17-5-6-10A	5.5E+04	1	0.3	NA	Gastrointestinal
Vanadium	13 / 28	4.6E+01	MR02-IS17-5-6-10A	3.9E+02	1	0.1	NA	Hair, Blood
Cumulative Corresponding Hazard Index^c						0.8		
Cumulative Corresponding Cancer Risk^d							1E-04	
							Total Neurological HI =	0.3
							Total Developmental HI =	0.3
							Total Gastrointestinal HI =	0.3
							Total Blood HI =	0.1
							Total Hair HI =	0.1

Notes:

a Corresponding Hazard Index equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

b Corresponding Cancer Risk equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.

d Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05, otherwise, constituent not selected as COPC.

Constituents selected as COPCs are indicated by shading.

CNS = Central Nervous System

COPC = Constituent of Potential Concern

mg/kg = micrograms per kilogram

NA = Not available/not applicable.

TABLE 2.5b

Risk Ratio Screening for Subsurface Soil, 95% UCL Concentration

Site UXO-2

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	95% UCL		95% UCL Rationale	Screening Level	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Risk ^b	Target Organ
Metals (ug/L)									
Arsenic	17 / 28	2.0E+00	95% KM-BCA	1, 3	3.9E-01	1.E-06	NA	5.E-06	NA
Chromium	20 / 28	2.4E+01	97.%5 KM	4	2.9E-01	1.E-06	NA	8.E-05	NA
Cumulative Corresponding Hazard Index ^c							NA		
Cumulative Corresponding Cancer Risk ^d								9E-05	

^a Corresponding Hazard Index equals 95% UCL divided by the RSL divided by the acceptable risk level.^b Corresponding Cancer Risk equals 95% UCL divided by the RSL divided by the acceptable risk level.^c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.^d Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-06

Constituents selected as COPCs are indicated by shading.

mg/kg = milligrams per kilogram

HI = Hazard Index

ProUCL, Version 4.00.05 used to determine distribution of data and calculate 95% UCL, following recommendations

in users guide (USEPA, May 2010, ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

Options: 95% Kaplan-Meier (t) UCL (95% KM-t); 95% KM BCA UCL (95% KM-BCA)

UCL Rationale:

(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.

(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.

(3) Test indicates data are gamma distributed.

(4) Distribution tests are inconclusive

LEAD MODEL FOR WINDOWS Version 1.1

=====

Model Version: 1.1 Build9

User Name:

Date:

Site Name:

Operable Unit:

Run Mode: Research

=====

***** Air *****

Indoor Air Pb Concentration: 30.000 percent of outdoor.

Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m ³ /day)	Lung Absorption (%)	Outdoor Air Pb Conc (µg Pb/m ³)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

***** Diet *****

Age	Diet Intake(µg/day)
.5-1	2.260
1-2	1.960
2-3	2.130
3-4	2.040
4-5	1.950
5-6	2.050
6-7	2.220

***** Drinking Water *****

Water Consumption:

Age Water (L/day)

.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 5.900 µg Pb/L

***** Soil & Dust *****

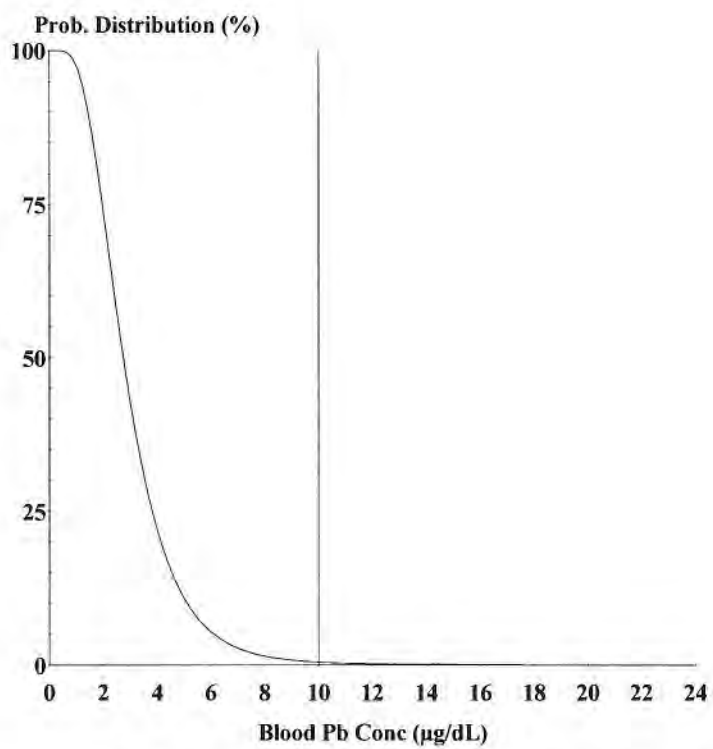
Multiple Source Analysis Used

Average multiple source concentration: 150.000 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700

Outdoor airborne lead to indoor household dust lead concentration: 100.000

Use alternate indoor dust Pb sources? No



Cutoff = 10.000 µg/dl
Geo Mean = 2.873
GSD = 1.600
% Above = 0.398

Age Range = 0 to 84 months
Run Mode = Research

Appendix H

Ecological Risk Screening Tables

CHECKLIST FOR ECOLOGICAL ASSESSMENTS/SAMPLING

I. SITE LOCATION

1. Site Name UXO 2 (includes Site 69 -The Rifle Range Chemical Dump)
US EPA ID Number _____
Location United States Marine Corps Base (MCB), Camp Lejeune
County Onslow City Jacksonville State NC
2. Latitude 34°34'44.94" N Longitude 72°25'51.44" W
3. Attach site maps, including a topographical map, a diagram which illustrates the layout of the facility (e.g., site boundaries, structures, etc.), and maps showing all habitat areas identified in Section III of the checklist. Also, include maps which illustrate known and suspected release areas, sampling locations and any other important features, if available. Figure 2-1 of this report presents site location and site boundaries. Figures 3-3 to 3-5 are aerials figure showing sample locations.

II. SITE CHARACTERIZATION

1. Indicate the approximate area of the site (i.e., acres or sq. ft.) Approximately 127 acres
2. Is this the first site visit? ☐ Yes ☒ No
If no, attach trip report of previous site visit(s), if available. No trip report is available
Dates(s) of previous site visit(s) CH2M HILL performed several site investigations in 2009 and 2010
3. Are aerial or other site photographs available? ☒ Yes ☐ No
If yes, please attach any available photo(s) to the site map to the report.
Figure 2-1 of this report.
4. Provide an approximate breakdown of the land uses on the site:

_____ % Heavy Industrial	_____ % Light Industrial	_____ % Urban
_____ % Residential	_____ % Rural	_____ % Agricultural ^b
_____ % Recreational ^a	<u>100</u> % Undisturbed	_____ % Other ^c

^aFor recreational areas, please describe the use of the area (e.g., park, playing field, etc).

^bFor agricultural areas, please list the crops and/or livestock which are present.

^cFor areas designated as "other," please describe the use of the area.

5. Provide an approximate breakdown of the land uses in the area surrounding the site. Indicate the radius (in miles) of the area described: 0.5 mile radius

<u> </u> % Heavy Industrial	<u> </u> % Light Industrial	<u> </u> % Urban
<u> </u> % Residential	<u> </u> % Rural	<u> </u> % Agricultural ^b
<u> </u> % Recreational ^a	<u>100</u> % Undisturbed	<u> </u> % Other ^c

^aFor recreational areas, please describe the use of the area (e.g., park, playing field, golf course, etc).

^bFor agricultural areas, please list the crops and/or livestock which are present.

^cFor areas designated as "other," please describe the use of the area.

6. Has any movement of soil taken place at the site? X Yes ☐ No
If yes, indicate the likely source of the disturbance, (e.g., erosion, agricultural, mining, industrial activities, removals, etc.) degree of disturbance, and estimate when these events occurred. A dirt road was constructed around Site 69 outside of the fenceline.

7. Do any sensitive environmental areas exist adjacent to or in proximity to the site, (e.g. Federal and State parks, National and State monuments, wetlands)? *Remember, flood plains and wetlands are not always obvious; do not answer "no" without confirming information. See Table 1 for a list of contacts.* Yes, wetlands are present along the eastern edge of the site.

Please provide the source(s) of information used to identify these sensitive areas, and indicate their general location on the site map.

MCB Camp Lejeune GIS Layer for Wetlands (NWI).

United States Marine Corps (USMC). 2006. Integrated Natural Resource Management Plan (INRMP) 2007-2011, Marine Corps Base Camp Lejeune, Onslow County, North Carolina. November.

8. What type of facility is located at the site?

☐ Chemical ☐ Manufacturing ☐ Mixing

X Waste Disposal X Other (specify)

Historically, UXO 2 or Site 69 was a chemical waste dump site. Currently, the Site is undisturbed and the Site 69 portion is enclosed by a six foot chain link fence.

9. Identify the contaminants of potential concern (COPCs) at the site. If known, include the maximum contaminant levels. Please indicate the source of data cited (e.g., RFI, confirmatory sampling, etc).
According to the data, VOCs, SVOCs, pesticides, PCBs, and metals were detected in the media onsite. Refer to the ERS for a detailed analysis.
10. Check any potential routes of off-site migration of contaminants observed at the site:
- X Swales ☐ Depressions ☐ Drainage Ditches
- X Runoff ☐ Windblown Particulates ☐ Vehicular Traffic
- X Other (specify): Groundwater
11. Indicate the approximate depth to groundwater (in feet below ground surface [(bgs)]).
Depth to groundwater ranges from 5 to 15 feet bgs.
12. Indicate the direction of groundwater flow (e.g., north, southeast, etc.)
Groundwater generally flows to the east and northeast towards the New River and associated tributary.
13. Is the direction of surface runoff apparent from site observations? X Yes ☐ No
If yes, to which of the following does the surface runoff discharge? Indicate all that apply.
- X Surface water X Groundwater ☐ Sewer
- ☐ Collection Impoundment
14. Is there a navigable water body or tributary to a navigable water body?
☐ Yes X No
15. Is there a water body anywhere on or in the vicinity of the site? If yes, also complete Section III.B.1: Aquatic Habitat Checklist -- Non-Flowing Systems and/or Section III.B.2: Aquatic Habitat Checklist -- Flowing Systems.
- X Yes (immediately adjacent to UXO-2) ☐ No
16. Is there evidence of flooding? X Yes: ☐ No
Wetlands and flood plains are not always obvious. Do not answer "no" without confirming information. If yes, complete Section III.C: Wetland Habitat Checklist.
17. If a field guide was used to aid any of the identifications, please provide a reference. Also, estimate the time spent identifying fauna. (Use a blank sheet if additional space is needed for text.)

18. Are any threatened and/or endangered species (plant or animal) known to inhabit the area of the site? ☐ Yes ☒ No

If yes, you are required to verify this information with the U.S. Fish and Wildlife Service or other appropriate agencies (see Table 1 for a list of contacts). If species' identities are known, please list them next.

19. Record weather conditions at the site at the time of the site visit when information for completion of this checklist was prepared:

DATE July 2009

Warm Temperature (°C/°F)

Wind (direction/speed):

Cloud Cover: Cloudy

Normal daily high temperature (°C/°F):

Precipitation (rain, snow): Chance of rain

20. Describe reasonable and likely future land and/or water use(s) at the site.

Land and water use will likely remain the same.

21. Describe the historical uses of the site. Include information on chemical releases that may have occurred as a result of previous land uses. For each chemical release, provide information on the form of the chemical released (i.e., solid, liquid, vapor) and the known or suspected causes or mechanism of the release (i.e., spills, leaks, material disposal, dumping, explosion, etc.).

UXO 2 includes Site 69, which was used from 1950 to 1976 for the disposal of chemical wastes including polychlorinated biphenyls (PCBs), solvents and pesticides into trenches. Site 69 is discussed in a separate Ecological Checklist.

No known investigations have been conducted in other areas of Site UXO 2 excluding Site 69. The Final Range Identification and Preliminary Range Assessment states that the range “appears on a range map circa 1973 and no information has been found to describe its use.” Site UXO 2 appears as an “unknown UXO contaminated area” in subsequent range overlay maps starting in 1987 (USACE, 2001). Plate 4, the 1946 Range overlay map, indicates mortar range “L-2” was established in a 1945 Camp Training Order (Figure 2-2 of Appendix B). However, by March 1946, it was disestablished and no longer used for firing live ammunition. Based upon the range designations and use at other similar ranges on MCB CamLej, 60 millimeter (mm) and 81 mm mortar (practice, high explosive [HE] white phosphorus, illumination) may have been fired on Mortar Range “L-2” (USACE, 2001). Mortar Range “L-2” had its firing position along the southern boundary of UXO 2 with impact trajectories due north into the New River.

22. Identify the media (e.g., soil [surface or subsurface], surface water, air, groundwater) which are known or suspected to contain COCs.

According to the data, metals were detected in the surface soil, subsurface soil, surface water, and groundwater onsite. Explosives were also detected in the sediment.

II.A. SUMMARY OF OBSERVATIONS AND SITE SETTING

Include information on significant source areas and migration pathways that are likely to constitute complete exposure pathways.

Soil exposure and groundwater to surface water and sediment exposures may be complete pathways.

Checklist Completed by Sara Kent

Affiliation CH2M HILL

Author Assisted by _____

Date 8/18/2010

III. HABITAT EVALUATION

III.A Terrestrial Habitat Checklist

III.A.1 Wooded

Are any wooded areas on or adjacent to the site? X Yes ☐ No

If yes, indicate the wooded area on the attached site map and answer the following questions. If more than one wooded area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual wooded area. Distinguish between wooded areas by using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.A.2: Shrub/Scrub

Wooded Area Questions

X On-site X Off-site

Name or Designation: UXO 2 – including Site 69 - Rifle Range Chemical Debris Dump

1. Estimate the approximate size of the wooded area (On-site: 100%, 127 acres; Off-site: 100%) Please identify what information was used to determine the wooded area of the site (e.g., direct observation, photos, etc). Google Earth aerial images and site photos.



2. Indicate the dominant type of vegetation in the wooded area. Provide photographs, if available.

- ☐ Evergreen
- ☐ Deciduous
- X Mixed

Dominant plant species, if known: Loblolly pine (*Pinus taeda*)

3. Estimate the vegetation density of the wooded area.

- ☐ Dense (i.e., greater than 75% vegetation)
- X Moderate (i.e., 25% to 75% vegetation)
- ☐ Sparse (i.e., less than 25% vegetation)

4. Indicate the predominant size of the trees at the site. Use diameter at breast height.

- ☐ 0-6 inches
- X 6-12 inches
- ☐ >12 inches
- ☐ No single size range is predominant

5. Specify type of understory present, if known. Provide a photograph, if available. Sparse, un-vegetated understory

III.A.2 Shrub/Scrub

Are any shrub/scrub areas on or adjacent to the site? ☐ Yes ☒ No

If yes, indicate the shrub/scrub area on the attached site map and answer the following questions. If more than one shrub/scrub area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual shrub/scrub area. Distinguish between shrub/scrub areas, using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.A.3: Open Field

III.A.3 Open Field

Are any open field areas on or adjacent to the site? ☐ Yes ☒ No

If yes, indicate the open field area on the attached site map and answer the following questions. If more than one open field area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual open field area. Distinguish between open field areas, using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.A.4: Miscellaneous

III.A.4 Miscellaneous

Are other types of terrestrial habitats present at the site, other than woods, scrub/shrub and open field? ☐ Yes ☒ No

If yes, indicate the area on the attached site map and answer the following questions. If more than one of these areas are present on or adjacent to the site, make additional copies of the following questions and fill out for each individual area. Distinguish between areas by using names or other designations. Clearly identify each area on the site map.

If no, proceed to Section III.B: Aquatic Habitats.

III.B Aquatic Habitats

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section III.C, Wetland Habitat Checklist.

III.B.1 Non-Flowing Systems

Are any non-flowing aquatic features (such as ponds or lakes) located at or adjacent to the site?

☐ Yes ☒ No

If yes, indicate the aquatic feature on the attached site map and answer the following questions regarding the non-flowing aquatic features. If more than one non-flowing aquatic feature is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual aquatic feature. Distinguish between aquatic features by using names or other designations. Clearly identify each area on the site map.

If no, proceed to Section III.B.2: Flowing Systems

III.B.2 Flowing Systems

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section III.C, Wetland Habitat Checklist.

Are any flowing aquatic features (such as streams or rivers) located at or adjacent to the site?

☒ Yes ☐ No

If yes, indicate the system on the attached site map and answer the following questions regarding the flowing system. If more than one flowing system is present on or adjacent to the site, make additional copies of the following questions and complete one set for each individual aquatic feature. Distinguish between flowing systems by using names or other designation. Clearly identify each area on the site map

If no, proceed to Section III.C: Wetlands Habitats.

Flowing Aquatic Systems Questions

☐ On-site X Off-site

Name or Designation: Un-named tributaries to the New River located immediately north and west of the site

1. Indicate the type of flowing aquatic feature present.

- ☐ River
- X Stream/Creek/Brook
- ☐ Intermittent stream
- ☐ Artificially created (ditch, etc.)
- ☐ Channeling
- ☐ Other (specify)

2. For natural systems, are there any indicators of physical alteration (e.g., channeling, debris, etc.)? ☐ Yes ☐ No X Unknown, not described during site visits
If yes, please describe the indicators observed.

3. Indicate the general composition of the bottom substrate. Unknown not described during site visits

- | | | |
|--|--|--|
| <input type="checkbox"/> Bedrock | <input type="checkbox"/> Sand (course) | <input type="checkbox"/> Concrete |
| <input type="checkbox"/> Boulder (>10 in.) | <input type="checkbox"/> Silt (fine) | <input type="checkbox"/> Debris |
| <input type="checkbox"/> Cobble (2.5 - 10 in.) | <input type="checkbox"/> Clay (slick) | <input type="checkbox"/> Detritus |
| <input type="checkbox"/> Gravel (0.1 - 2.5 in.) | <input type="checkbox"/> Muck (fine/black) | <input type="checkbox"/> Marl (Shells) |
| <input type="checkbox"/> Other (please specify): _____ | | |

4. Describe the condition of the bank (e.g., height, slope, extent of vegetative cover).
Unknown, not described during site visits

5. Is the system influenced by tides? X Yes ☐ No
What information was used to make this determination? Proximity to the New River

6. Is the flow intermittent? ☐ Yes X No
If yes, please note the information used to make this determination. The stream appears on the USGS topo maps.

Flowing System Questions (Continued)

7. Is there a discharge from the site to the water body? ☒ Yes ☐ No
If yes, describe the origin of each discharge and its migration path.
Potentially surface water runoff (overland flow) reaches the tributary.
8. Indicate the discharge point of the water body. Specify name of the discharge, if known.
New River
9. Identify any field measurements and observations of water quality that were made.
Provide the measurement and the units of measure in the appropriate space below:

_____ Width (ft.)

_____ Depth (average)

_____ Velocity (specify units): _____

_____ Temperature (depth of water where the reading was taken) _____

_____ pH

_____ Dissolved oxygen

_____ Salinity

_____ Turbidity (clear, slightly turbid, turbid, opaque)
(Secchi disk depth _____)

_____ Other (specify)

10. Describe observed color and area of coloration. Unknown, not described during site visits

11. Is any aquatic vegetation present? ☐ Yes ☐ No ☒ Unknown, not described during site visits

If yes, please identify the type of vegetation present, if known.

☒ Emergent ☐ Submergent ☐ Floating

Flowing System Questions (Continued)

12. Mark the flowing water system on the attached site map.
13. What observations were made at the water body regarding the presence and/or absence of benthic macroinvertebrates, fish, birds, mammals, etc? Unknown, not described during site visits

III.C Wetland Habitats

Are any wetland¹ areas such as marshes or swamps on or adjacent to the site?

X Yes ☐ No

If yes, indicate the wetland area on the attached site map and answer the following questions regarding the wetland area. If more than one wetland area is present on or adjacent to the site, make additional copies of the following questions and fill out one for each individual wetland area. Distinguish between wetland areas by using names or other designations (such as location). Clearly identify each area on the site map. Also, obtain and attach a National Wetlands Inventory Map (or maps) to illustrate each wetland area.

Identify the sources of the observations and information (e.g., National Wetland Inventory, Federal or State Agency, USGS topographic maps) used to make the determination whether or not wetland areas are present.

MCB, Camp Lejeune, North Carolina 2007-2011 Integrated Natural Resource Management Plan (INRMP), 2006.

MCB Camp Lejeune GIS Layer for Wetlands (NWI)

If no wetland areas are present, proceed to Section III.D: Sensitive Environments and Receptors.

¹Wetlands are defined in 40 CFR §232.2 as “ Areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” Examples of typical wetlands plants include: cattails, cordgrass, willows and cypress trees. National wetland inventory maps may be available at <http://nwi.fws.gov>. Additional information on wetland delineation criteria is also available from the Army Corps of Engineers.

Wetland Area Questions

X On-site ☐ Off-site

Name or Designation: Wetlands are located within the UXO 2 site boundaries.

1. Indicate the approximate area of the wetland (acres or ft.²) the NWI map indicates wetlands are present in the northeast area of the site. Field observations confirmed wetland areas are present within the ravines along the eastern edge of the site.
2. Identify the type(s) of vegetation present in the wetland.
 - ☐ Submergent (i.e., underwater) vegetation
 - X Emergent (i.e., rooted in the water, but rising above it) vegetation
 - ☐ Floating vegetation
 - X Scrub/shrub
 - X Wooded
 - ☐ Other (Please describe): _____
3. Provide a general description of the vegetation present in and around the wetland (height, color, etc). Provide a photograph of the known or suspected wetlands, if available.
Wetlands were observed within the ravines located along the eastern edge of the site adjacent to the New River and unnamed tributary. The wetlands were predominantly forested with few herbaceous species.
4. Estimate the vegetation density of the wetland area.
 - ☐ Dense (i.e., greater than 75% vegetation)
 - X Moderate (i.e., 25% to 75% vegetation)
 - ☐ Sparse (i.e., less than 25% vegetation)
5. Is standing water present? X Yes ☐ No
If yes, is the water primarily: ☐ Fresh X Brackish
Indicate the approximate area of the standing water (ft.²): Unknown
Indicate the approximate depth of the standing water, if known (ft. or in.) Unknown

Wetland Area Questions (Continued)

6. Identify any field measurements and observations of water quality that were made. Provide the measurement and the units of measure in the appropriate space below:

Depth (average)

Temperature (depth of water where the reading was taken)

pH

Dissolved oxygen

Salinity

Turbidity (clear, slightly turbid, turbid, opaque) (Secchi disk depth_____)

Other (specify)

Other(specify)

7. Describe observed color and area of coloration. None recorded

8. If known, indicate the source of the water in the wetland.

X Stream/River/Creek/Lake/Pond

X Flooding (Potentially)

X Groundwater (Potentially)

X Surface runoff

9. Is there a discharge from the site to the wetland? X Yes ☐ No

If yes, please describe:

Runoff from the Site flows into the ravines along the eastern edge of the site and through the wetlands.

Wetland Area Questions (Continued)

10. Is there a discharge from the wetland? ☒ Yes ☐ No
If yes, to what water body is discharge released?

☒ Marine (Name: New River)
☒ Surface stream/River (Name: Unnamed tributary)
☐ Lake/Pond (Name: _____)
☐ Groundwater
☐ Not sure

11. Does the area show evidence of flooding? ☒ Yes ☐ No
If yes, indicate which of the following are present (mark all that apply).

☒ Standing water
☒ Water-saturated soils
☐ Water marks
☐ Buttressing
☐ Debris lines
☐ Mud cracks
☐ Other (Please describe)

11. If a soil sample was collected, describe the appearance of the soil in the wetland area.
Circle or write in the best response. None collected.

Color (blue/gray, brown, black, mottled) _____

Water content (dry, wet, saturated/unsaturated) _____

13. Mark the observed wetland area(s) on the attached site map.

III.D Sensitive Environments and Receptors

1. Do any other potentially sensitive environmental areas² exist adjacent to or within one-half mile of the site? If yes, list these areas and provide the source(s) of information used to identify sensitive areas. *Do not answer "no" without confirmation from the U.S. Fish and Wildlife Service and other appropriate agencies. See Table 1 for a list of contacts.*

No

4. Are any areas on or near (i.e., within one-half mile) the site owned or used by local tribes? If yes, describe.

No

3. Does the site serve or potentially serve as a habitat, foraging area or refuge by rare, threatened, endangered, candidate and/or proposed species (plants or animals), or any otherwise protected species? If yes, identify species. *This information should be obtained from the U.S. Fish and Wildlife Service and other appropriate agencies. See Table 1 for a list of contacts.*

No

5. Is the site potentially used as a breeding, roosting or feeding area by migratory bird species? If yes, identify which species.

Unknown.

6. Is the site used by any ecologically³, recreationally or commercially important species? If yes, explain.

No

² Areas that provide unique and often protected habitat for wildlife species. These areas are typically used during critical life stages such as breeding, hatching, rearing of young and overwintering. Refer to Table 2 at the end of this document for examples of sensitive environments.

³ Ecologically important species include populations of species which provide a critical (i.e., not replaceable) food resource for higher organisms. These species' functions would not be replaced by more tolerant species or perform a critical ecological function (such as organic matter decomposition) and will not be replaced by other species. Ecologically important species include pest and opportunistic species that populate an area if they serve as a food source for other species, but do not include domesticated animals (e.g., pets and livestock) or plants/animals whose existence is maintained by continuous human interventions (e.g., fish hatcheries, agricultural crops, etc).

IV. EXPOSURE PATHWAY EVALUATION

1. Do existing data provide sufficient information on the nature, rate and extent of contamination at the site?

☒ Yes
☐ No
☐ Uncertain

Please provide an explanation for your answer.

Data were collected from each medium onsite, providing representative samples for the area of concern.

2. Do existing data provide sufficient information on the nature, rate and extent of contamination in offsite affected areas?

☒ Yes
☐ No
☐ Uncertain
☐ No offsite contamination

Please provide an explanation for your answer.

See #1 of this section.

3. Do existing data address potential migration pathways of contaminants at the site?

☒ Yes
☐ No
☐ Uncertain

Please provide an explanation for your answer.

Data were collected based on potential migration pathways (i.e. overland flow, leaching, and groundwater transport).

4. Do existing data address potential migration pathways of contaminants in offsite affected areas?

☐ Yes
☐ No
☐ Uncertain
☒ No offsite contamination

Please provide an explanation for your answer. Concentration of COPCs in groundwater are not expected to be high enough to cause any discernable impact to the New River.

5. Are there visible indications of stressed habitats or receptors on or near (i.e., within one-half mile) the site that may be the result of a chemical release? If yes, explain. Attach photographs if available.

No

6. Is the location of the contamination such that receptors might be reasonably expected to come into contact with it? For soil, this means contamination in the soil 0 to 1 foot below ground surface (bgs). If yes, explain.

Metals and explosives were detected in areas where receptors may be exposed.

7. Are receptors located in or using habitats where chemicals exist in air, soil, sediment or surface water? If yes, explain.

Unknown. No receptors were identified during the field visits.

8. Could chemicals reach receptors via groundwater? Can chemicals leach or dissolve to groundwater? Are chemicals mobile in groundwater? Does groundwater discharge into receptor habitats? If yes, explain.

Water level measurement data suggests that shallow groundwater within the vicinity of the site generally flows northeast. The New River is located directly adjacent to the site. Should the low level concentrations in groundwater migrate toward the river, concentrations will likely dilute and attenuate to the extent that aquatic receptors would not be at risk.

9. Could chemicals reach receptors through runoff or erosion? Answer the following questions.

Overland runoff could contribute COPCs to the un-named tributaries and to the New River.

10. What is the approximate distance from the contaminated area to the nearest watercourse?

- ☒ 0 feet (i.e., contamination has reached a watercourse)
- ☐ 1-10 feet
- ☐ 11-20 feet
- ☐ 21-50 feet
- ☐ 51-100 feet
- ☐ 101-200 feet
- ☐ > 200 feet
- ☐ > 500 feet
- ☐ > 1000 feet

11. What is the slope of the ground in the contaminated area?

- X 0-10%
- ☐ 10-30%
- ☐ > 30%

12. What is the approximate amount of ground and canopy vegetative cover in the contaminated area?

- ☐ < 25%
- X 25-75%
- ☐ > 75%

13. Is there visible evidence of erosion (e.g., a rill or gully) in or near the contaminated area?

- ☐ Yes
- X No
- ☐ Do not know

14. Do any structures, pavement or natural drainage features direct run-on flow (i.e., surface flows originating upstream or uphill from the area of concern) into the contaminated area?

- ☐ Yes
- X No
- ☐ Do not know

15. Could chemicals reach receptors through the dispersion of contaminants in air (e.g., volatilization, vapors, fugitive dust)? If yes, explain.

No

16. Could chemicals reach receptors through migration of non-aqueous phase liquids (NAPLs)? Is a NAPL present at the site that might be migrating towards receptors or habitats? Could NAPL discharge contact receptors or their habitat?

No

TABLE 1
UXO 02 Surface Soil Screen
MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance ¹	Maximum Hazard Quotient	Arithmetic Mean	Mean Hazard Quotient	2 X Mean Background	Exceeds 2 X Mean Background?	Supplemental Screening Value	Source	Supplemental Maximum HQ	Retain?	Rationale
Semivolatile Organic Compounds (UG/KG)																
2,4-Dinitrotoluene	200 - 1,400	0 / 205	--	--	NSV	-- / --	NSV	317	NSV	--	--	--	--	--	No	Not detected
2,6-Dinitrotoluene	200 - 1,400	0 / 205	--	--	NSV	-- / --	NSV	317	NSV	--	--	--	--	--	No	Not detected
Nitrobenzene	200 - 1,400	0 / 205	--	--	40,000	-- / --	0.035	317	0.0079	--	--	--	--	--	No	HQ less than one, not detected
Explosives (UG/KG)																
1,3,5-Trinitrobenzene	460 - 1,400	0 / 205	--	--	NSV	-- / --	NSV	322	NSV	--	--	--	--	--	No	Not detected
1,3-Dinitrobenzene	460 - 1,400	0 / 205	--	--	NSV	-- / --	NSV	322	NSV	--	--	--	--	--	No	Not detected
2,4,6-Trinitrotoluene	460 - 1,400	0 / 205	--	--	NSV	-- / --	NSV	322	NSV	--	--	--	--	--	No	Not detected
2-Amino-4,6-dinitrotoluene	460 - 1,400	0 / 205	--	--	NSV	-- / --	NSV	322	NSV	--	--	--	--	--	No	Not detected
2-Nitrotoluene	460 - 1,400	0 / 205	--	--	NSV	-- / --	NSV	322	NSV	--	--	--	--	--	No	Not detected
3-Nitrotoluene	460 - 1,400	0 / 205	--	--	NSV	-- / --	NSV	322	NSV	--	--	--	--	--	No	Not detected
4-Amino-2,6-dinitrotoluene	460 - 1,400	0 / 205	--	--	NSV	-- / --	NSV	322	NSV	--	--	--	--	--	No	Not detected
4-Nitrotoluene	460 - 1,400	0 / 205	--	--	NSV	-- / --	NSV	322	NSV	--	--	--	--	--	No	Not detected
HMX	460 - 1,400	0 / 205	--	--	NSV	-- / --	NSV	322	NSV	--	--	--	--	--	No	Not detected
Nitroglycerin	730 - 2,200	1 / 205	860	MR02-IR69-SS17-10A	NSV	-- / --	NSV	517	NSV	--	--	36000	Bernard et al., 2008	0.02	No	Supplemental HQ less than one
Perchlorate	220 - 6,800	0 / 205	--	--	NSV	-- / --	NSV	1.39	NSV	--	--	--	--	--	No	Not detected
PETN	1,400 - 4,100	0 / 205	--	--	NSV	-- / --	NSV	967	NSV	--	--	--	--	--	No	Not detected
RDX	460 - 1,400	0 / 205	--	--	NSV	-- / --	NSV	322	NSV	--	--	--	--	--	No	Not detected
Tetryl	460 - 1,400	0 / 205	--	--	NSV	-- / --	NSV	322	NSV	--	--	--	--	--	No	Not detected
Inorganics (MG/KG)																
Aluminum	-- --	205 / 205	13,600	MR02-SS12-10A	50.0	205 / 205	272	3,214	64.3	5487	Yes	--	--	--	No	Within background range
Antimony	1.40 - 4.70	16 / 205	3.20	MR02-SS121-10A	0.27	3 / 205	11.9	1.07	3.96	0.45	Yes	--	--	--	No	Low exceedance frequency
Arsenic	0.43 - 1.20	172 / 205	8.30	MR02-SS24-10A	18.0	0 / 205	0.46	0.60	0.033	0.63	Yes	--	--	--	No	HQ less than one
Barium	30.0 - 75.0	148 / 205	93.2	MR02-SS05-10A	330	0 / 205	0.28	18.9	0.057	14.5	Yes	--	--	--	No	HQ less than one
Beryllium	0.68 - 2.40	41 / 205	0.51	MR02-SS05-10A	21.0	0 / 205	0.024	0.47	0.023	0.10	Yes	--	--	--	No	HQ less than one, within background range
Cadmium	0.48 - 1.40	34 / 205	0.13	MR02-SS176-10A	0.36	0 / 205	0.36	0.33	0.92	0.03	Yes	--	--	--	No	HQ less than one
Calcium ²	680 - 2,400	25 / 205	39,700	MR02-IR69-SS15-10A	NSV	-- / --	NSV	915	NSV	6360	Yes	--	--	--	No	Macronutrient
Chromium	1.40 - 4.40	146 / 205	12.9	MR02-SS24-10A	26.0	0 / 205	0.50	2.54	0.098	6.054	Yes	--	--	--	No	HQ less than one
Cobalt	6.80 - 19.0	125 / 205	2.00	MR02-SS92-10A	13.0	0 / 205	0.15	2.33	0.18	0.29	Yes	--	--	--	No	HQ less than one
Copper	3.40 - 12.0	13 / 205	7.80	MR02-SS183-10A	28.0	0 / 205	0.28	2.89	0.10	4.83	Yes	--	--	--	No	HQ less than one, within background range
Iron	-- --	205 / 205	20,800	MR02-SS24-10A	200	202 / 205	104	1,423	7.11	3245	Yes	--	--	--	No	background
Lead	-- --	205 / 205	221	MR02-IR69-SS17-10A	11.0	26 / 205	20.1	8.13	0.74	12.3	Yes	--	--	--	No	Only 1 of 205 samples exceeded maximum background
Magnesium ²	680 - 2,400	0 / 205	--	--	NSV	-- / --	NSV	564	NSV	238	Yes	--	--	--	No	Macronutrient
Manganese	-- --	205 / 205	594	MR02-SS149-10A	220	1 / 205	2.70	42.9	0.20	13.7	Yes	--	--	--	No	Low exceedance frequency
Mercury	0.14 - 0.33	169 / 205	0.14	MR02-SS171-10A	0.10	4 / 205	1.40	0.045	0.45	0.08	Yes	--	--	--	No	Low exceedance frequency
Nickel	5.40 - 18.0	76 / 205	9.30	MR02-SS24-10A	38.0	0 / 205	0.24	3.34	0.088	1.21	Yes	--	--	--	No	HQ less than one
Potassium ²	680 - 2,400	44 / 205	591	MR02-IR69-SS15-10A	NSV	-- / --	NSV	473	NSV	116	Yes	--	--	--	No	Macronutrient
Selenium	0.79 - 1.90	114 / 205	0.57	MR02-SS12-10A	0.52	4 / 205	1.10	0.38	0.73	0.56	Yes	--	--	--	No	Low exceedance frequency, within background range
Silver	1.40 - 4.70	1 / 205	0.060	MR02-SS44-10A	4.20	0 / 205	0.014	1.13	0.27	0.14	No	--	--	--	No	HQ less than one, consistent with background
Sodium ²	680 - 2,400	24 / 205	168	MR02-SS81-10A	NSV	-- / --	NSV	504	NSV	80.9	Yes	--	--	--	No	Macronutrient
Thallium	0.34 - 1.20	3 / 205	0.050	MR02-IR69-SS01D-10A	1.00	0 / 205	0.050	0.28	0.28	0.36	No	--	--	--	No	HQ less than one, consistent with background
Vanadium	8.50 - 19.0	147 / 205	18.1	MR02-SS07-10A	7.80	18 / 205	2.32	4.43	0.57	8.90	Yes	--	--	--	No	Within background range
Zinc	2.70 - 6.00	147 / 205	53.3	MR02-SS14-10A	46.0	1 / 205	1.16	7.85	0.17	10.8	Yes	--	--	--	No	Low exceedance frequency, within background range

NOTES

1 - Count of detected samples exceeding or equaling Screening Value
2 - Macronutrient - Not considered to be a COPC
HQ - Hazard Quotient
MG/KG - Milligrams per kilogram
NSV - No Screening Value
UG/KG - Micrograms per kilogram

Generated by: Kelly Taylor
Checked by: Sara Kent

TABLE 2

UXO 02 Subsurface Soil Screen

MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance ¹	Maximum Hazard Quotient	Arithmetic Mean	Mean Hazard Quotient	2 x Mean Background	Maximum Exceeds 2 x Mean Background?	Retain?	Rationale
Semivolatile Organic Compounds (UG/KG)													
2,4-Dinitrotoluene	450 - 610	0 / 19	--	--	NSV	-- / --	NSV	274	NSV			No	Not detected
2,6-Dinitrotoluene	450 - 610	0 / 19	--	--	NSV	-- / --	NSV	274	NSV			No	Not detected
Nitrobenzene	450 - 610	0 / 19	--	--	40,000	-- / --	0.015	274	0.0068			No	HQ less than one, not detected
Explosives (UG/KG)													
1,3,5-Trinitrobenzene	450 - 610	0 / 19	--	--	NSV	-- / --	NSV	274	NSV			No	Not detected
1,3-Dinitrobenzene	450 - 610	0 / 19	--	--	NSV	-- / --	NSV	274	NSV			No	Not detected
2,4,6-Trinitrotoluene	450 - 610	0 / 19	--	--	NSV	-- / --	NSV	274	NSV			No	Not detected
2-Amino-4,6-dinitrotoluene	450 - 610	0 / 19	--	--	NSV	-- / --	NSV	274	NSV			No	Not detected
2-Nitrotoluene	450 - 610	0 / 19	--	--	NSV	-- / --	NSV	274	NSV			No	Not detected
3-Nitrotoluene	450 - 610	0 / 19	--	--	NSV	-- / --	NSV	274	NSV			No	Not detected
4-Amino-2,6-dinitrotoluene	450 - 610	0 / 19	--	--	NSV	-- / --	NSV	274	NSV			No	Not detected
4-Nitrotoluene	450 - 610	0 / 19	--	--	NSV	-- / --	NSV	274	NSV			No	Not detected
HMX	450 - 610	0 / 19	--	--	NSV	-- / --	NSV	274	NSV			No	Not detected
Nitroglycerin	720 - 970	0 / 19	--	--	NSV	-- / --	NSV	438	NSV			No	Not detected
Perchlorate	2.20 - 2.70	0 / 19	--	--	NSV	-- / --	NSV	1.22	NSV			No	Not detected
PETN	1,400 - 1,800	0 / 19	--	--	NSV	-- / --	NSV	818	NSV			No	Not detected
RDX	450 - 610	0 / 19	--	--	NSV	-- / --	NSV	274	NSV			No	Not detected
Tetryl	450 - 610	0 / 19	--	--	NSV	-- / --	NSV	274	NSV			No	Not detected
Inorganics (MG/KG)													
Aluminum	-- - --	19 / 19	23,100	MR02-IS03-2-3-10A	50.0	18 / 19	462	4,804	96.1	10369	Yes	No	Only 1 of 19 samples exceeds background range
Antimony	1.40 - 2.20	1 / 19	0.10	MR02-IS29-4-5-10A	0.27	0 / 19	0.37	0.94	3.49	0.36	No	No	HQ less than one, consistent with background
Arsenic	0.44 - 0.55	10 / 19	4.50	MR02-IS03-2-3-10A	18.0	0 / 19	0.25	0.67	0.037	2.12	Yes	No	HQ less than one, within background range
Barium	35.0 - 44.0	14 / 19	30.2	MR02-IS08-4-5-10A	330	0 / 19	0.092	11.1	0.034	16.6	Yes	No	HQ less than one
Beryllium	0.71 - 1.10	0 / 19	--	--	21.0	-- / --	0.052	0.49	0.023	0.17	Yes	No	HQ less than one, not detected
Cadmium	0.49 - 0.78	0 / 19	--	--	0.36	-- / --	2.17	0.34	0.95	0.02	Yes	No	Not detected
Calcium ²	690 - 1,100	0 / 19	--	--	NSV	-- / --	NSV	475	NSV	441	Yes	No	Not detected
Chromium	1.80 - 2.20	13 / 19	25.6	MR02-IS03-2-3-10A	26.0	0 / 19	0.98	4.94	0.19	14.5	Yes	No	HQ less than one
Cobalt	7.10 - 11.0	6 / 19	0.52	MR02-IS25-4-5-10A	13.0	0 / 19	0.040	3.47	0.27	0.82	No	No	HQ, less than one, consistent with background
Copper	3.40 - 5.60	0 / 19	--	--	28.0	-- / --	0.20	2.39	0.085	2.56	Yes	No	HQ less than one, not detected
Iron	-- - --	19 / 19	9,870	MR02-IS03-2-3-10A	200	16 / 19	49.4	1,692	8.46	5439	Yes	No	Within background range
Lead	-- - --	19 / 19	5.80	MR02-IS08-4-5-10A	11.0	0 / 19	0.53	2.71	0.25	8.49	No	No	HQ less than one, consistent with background
Magnesium ²	690 - 1,100	0 / 19	--	--	NSV	-- / --	NSV	475	NSV	363	Yes	No	Not detected
Manganese	2.80 - 2.80	18 / 19	19.5	MR02-IS08-4-5-10A	220	0 / 19	0.089	7.53	0.034	9.25	Yes	No	HQ less than one, within background range
Mercury	0.13 - 0.19	9 / 19	0.040	MR02-IS13-2-3-10A	0.10	0 / 19	0.40	0.052	0.52	0.07	No	No	HQ less than one, consistent with background
Nickel	5.60 - 8.80	10 / 19	2.30	MR02-IS25-4-5-10A	38.0	0 / 19	0.061	2.22	0.058	2.27	Yes	No	HQ less than one, within background range
Potassium ²	870 - 1,100	7 / 19	1,270	MR02-IS03-2-3-10A	NSV	-- / --	NSV	463	NSV	361	Yes	No	Macronutrient
Selenium	0.89 - 1.10	12 / 19	0.51	MR02-IS03-2-3-10A	0.52	0 / 19	0.98	0.31	0.60	0.50	Yes	No	HQ less than one, within background range
Silver	1.40 - 2.20	2 / 19	0.070	MR02-IS25-4-5-10A	4.20	0 / 19	0.017	0.89	0.21	0.13	No	No	HQ less than one, consistent with background

TABLE 2

UXO 02 Subsurface Soil Screen

MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance ¹	Maximum Hazard Quotient	Arithmetic Mean	Mean Hazard Quotient	2 x Mean Background	Maximum Exceeds 2 x Mean Background?	Retain?	Rationale
Sodium ²	710 - 1,100	0 / 19	--	--	NSV	-- / --	NSV	488	NSV	68.3	Yes	No	Not detected
Thallium	0.44 - 0.55	13 / 19	0.16	MR02-IS03-2-3-10A	1.00	0 / 19	0.16	0.11	0.11	0.38	No	No	HQ less than one, consistent with background
Vanadium	7.40 - 11.0	7 / 19	33.1	MR02-IS03-2-3-10A	7.80	3 / 19	4.24	7.28	0.93	17.2	Yes	No	Within background range
Zinc	2.80 - 4.40	3 / 19	13.4	MR02-IS08-4-5-10A	46.0	0 / 19	0.29	3.18	0.069	6.59	Yes	No	HQ less than one, within background range

NOTES

1 - Count of detected samples exceeding or equaling Screening Value

2 - Macronutrient - Not considered to be a COPC

HQ - Hazard Quotient

NSV - No Screening Value

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Generated by: Kelly Taylor

Checked by: Sara Kent

TABLE 3

UXO 02 Sediment Screen

MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance ¹	Maximum Hazard Quotient	Arithmetic Mean	Mean Hazard Quotient	Supplemental Screening Value	Source	Supplemental Maximum HQ	Retain?	Rationale
Semivolatile Organic Compounds (UG/KG)														
2,4-Dinitrotoluene	630 - 3,400	0 / 10	--	--	NSV	-- / --	NSV	1,142	NSV	--	--	--	No	Not detected
2,6-Dinitrotoluene	630 - 3,400	0 / 10	--	--	NSV	-- / --	NSV	1,142	NSV	--	--	--	No	Not detected
Nitrobenzene	630 - 3,400	0 / 10	--	--	NSV	-- / --	NSV	1,142	NSV	--	--	--	No	Not detected
Explosives (UG/KG)														
1,3,5-Trinitrobenzene	630 - 3,400	0 / 10	--	--	NSV	-- / --	NSV	1,142	NSV	--	--	--	No	Not detected
1,3-Dinitrobenzene	630 - 3,400	0 / 10	--	--	NSV	-- / --	NSV	1,142	NSV	--	--	--	No	Not detected
2,4,6-Trinitrotoluene	630 - 3,400	0 / 10	--	--	NSV	-- / --	NSV	1,142	NSV	--	--	--	No	Not detected
2-Amino-4,6-dinitrotoluene	630 - 3,400	0 / 10	--	--	NSV	-- / --	NSV	1,142	NSV	--	--	--	No	Not detected
2-Nitrotoluene	630 - 3,400	0 / 10	--	--	NSV	-- / --	NSV	1,142	NSV	--	--	--	No	Not detected
3-Nitrotoluene	630 - 3,400	0 / 10	--	--	NSV	-- / --	NSV	1,142	NSV	--	--	--	No	Not detected
4-Amino-2,6-dinitrotoluene	630 - 3,400	0 / 10	--	--	NSV	-- / --	NSV	1,142	NSV	--	--	--	No	Not detected
4-Nitrotoluene	630 - 3,400	0 / 10	--	--	NSV	-- / --	NSV	1,142	NSV	--	--	--	No	Not detected
HMX	630 - 3,400	0 / 10	--	--	NSV	-- / --	NSV	1,142	NSV	--	--	--	No	Not detected
Nitroglycerin	1,000 - 5,400	0 / 10	--	--	NSV	-- / --	NSV	1,835	NSV	--	--	--	No	Not detected
Perchlorate	-- - --	10 / 10	19.0	MR02-SD06-10A	NSV	-- / --	NSV	10.5	NSV	--	--	--	No	See text discussion
PETN	1,900 - 10,000	0 / 10	--	--	NSV	-- / --	NSV	3,430	NSV	--	--	--	No	Not detected
RDX	630 - 3,400	0 / 10	--	--	NSV	-- / --	NSV	1,142	NSV	--	--	--	No	Not detected
Tetryl	630 - 3,400	0 / 10	--	--	NSV	-- / --	NSV	1,142	NSV	--	--	--	No	Not detected
Inorganics (MG/KG)														
Aluminum	-- - --	10 / 10	31,400	MR02-SD01-10A	NSV	-- / --	NSV	14,965	NSV	--	--	--	No	Within background range in soils
Antimony	2.10 - 14.0	0 / 10	--	--	2.00	-- / --	7.00	4.37	2.19	--	--	--	No	Not detected
Arsenic	-- - --	10 / 10	5.80	MR02-SD01-10A	7.24	0 / 10	0.80	2.59	0.36	--	--	--	No	HQ less than one
Barium	42.0 - 270	0 / 10	--	--	NSV	-- / --	NSV	87.1	NSV	--	--	--	No	Not detected
Beryllium	-- - --	10 / 10	1.10	MR02-SD06-10A	NSV	-- / --	NSV	0.43	NSV	--	--	--	No	Within background range in soils
Cadmium	0.74 - 4.80	0 / 10	--	--	0.68	-- / --	7.10	1.52	2.24	--	--	--	No	Not detected
Calcium ²	2,800 - 5,400	4 / 10	7,220	MR02-SD03-10A	NSV	-- / --	NSV	3,545	NSV	--	--	--	No	Macronutrient
Chromium	6.90 - 14.0	7 / 10	39.7	MR02-SD01-10A	52.3	0 / 10	0.76	16.8	0.32	--	--	--	No	HQ less than one
Cobalt	34.0 - 69.0	7 / 10	2.00	MR02-SD03-10A	NSV	-- / --	NSV	8.59	NSV	50	TCEQ, 2006	0.04	No	Supplemental HQ less than one
Copper	5.30 - 34.0	0 / 10	--	--	18.7	-- / --	1.82	10.8	0.58	--	--	--	No	Not detected
Iron	-- - --	10 / 10	16,800	MR02-SD01-10A	NSV	-- / --	NSV	7,431	NSV	20000	TCEQ, 2006	0.84	No	Supplemental HQ less than one
Lead	-- - --	10 / 10	24.5	MR02-SD04-10A	30.2	0 / 10	0.81	14.6	0.48	--	--	--	No	HQ less than one
Magnesium ²	1,000 - 6,900	4 / 10	7,930	MR02-SD03-10A	NSV	-- / --	NSV	3,611	NSV	--	--	--	No	Macronutrient
Manganese	-- - --	10 / 10	80.2	MR02-SD05-10A	NSV	-- / --	NSV	32.5	NSV	460	TCEQ, 2006	0.17	No	Supplemental HQ less than one
Mercury	0.15 - 1.00	0 / 10	--	--	0.13	-- / --	7.69	0.33	2.54	--	--	--	No	Not detected
Nickel	8.40 - 55.0	0 / 10	--	--	15.9	-- / --	3.46	17.4	1.09	--	--	--	No	Not detected
Potassium ²	1,000 - 6,900	0 / 10	--	--	NSV	-- / --	NSV	2,155	NSV	--	--	--	No	Not detected
Selenium	1.00 - 6.90	0 / 10	--	--	NSV	-- / --	NSV	2.16	NSV	--	--	--	No	Not detected
Silver	2.10 - 14.0	0 / 10	--	--	0.73	-- / --	19.1	4.37	5.96	--	--	--	No	Not detected
Sodium ²	1,000 - 6,900	5 / 10	18,600	MR02-SD05-10A	NSV	-- / --	NSV	7,266	NSV	--	--	--	No	Macronutrient
Thallium	0.53 - 3.40	0 / 10	--	--	NSV	-- / --	NSV	1.08	NSV	--	--	--	No	Not detected
Vanadium	-- - --	10 / 10	47.7	MR02-SD01-10A	NSV	-- / --	NSV	22.1	NSV	--	--	--	No	Within background range in soils
Zinc	14.0 - 14.0	9 / 10	48.9	MR02-SD05-10A	124	0 / 10	0.39	27.8	0.22	--	--	--	No	HQ less than one

NOTES

1 - Count of detected samples exceeding or equaling Screening Value

2 - Macronutrient - Not considered to be a COPC

HQ - Hazard Quotient

NSV - No Screening Value

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Generated by: Kelly Taylor

Checked by: Sara Kent

TABLE 4

UXO 02 Surface Water Screen
MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance ¹	Maximum Hazard Quotient	Arithmetic Mean	Mean Hazard Quotient	Supplemental Screening Value	Source	Supplemental Maximum Hazard Quotient	Retain?	Rationale
Semivolatile Organic Compounds (UG/L)														
2,4-Dinitrotoluene	0.26 - 0.26	0 / 10	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	No	Not detected
2,6-Dinitrotoluene	0.26 - 0.26	0 / 10	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	No	Not detected
Nitrobenzene	0.26 - 0.26	0 / 10	--	--	66.8	-- / --	0.0039	0.13	0.0019	--	--	--	No	HQ less than one, not detected
Explosives (UG/L)														
1,3,5-Trinitrobenzene	0.26 - 0.26	0 / 10	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	No	Not detected
1,3-Dinitrobenzene	0.26 - 0.26	0 / 10	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	No	Not detected
2,4,6-Trinitrotoluene	0.26 - 0.26	0 / 10	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	No	Not detected
2-Amino-4,6-dinitrotoluene	0.26 - 0.26	0 / 10	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	No	Not detected
2-Nitrotoluene	0.52 - 0.52	0 / 10	--	--	NSV	-- / --	NSV	0.26	NSV	--	--	--	No	Not detected
3-Nitrotoluene	0.52 - 0.52	0 / 10	--	--	NSV	-- / --	NSV	0.26	NSV	--	--	--	No	Not detected
4-Amino-2,6-dinitrotoluene	0.26 - 0.26	0 / 10	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	No	Not detected
4-Nitrotoluene	0.52 - 0.52	0 / 10	--	--	NSV	-- / --	NSV	0.26	NSV	--	--	--	No	Not detected
HMX	0.52 - 0.52	0 / 10	--	--	NSV	-- / --	NSV	0.26	NSV	--	--	--	No	Not detected
Nitroglycerin	2.00 - 2.00	0 / 10	--	--	NSV	-- / --	NSV	1.00	NSV	--	--	--	No	Not detected
Perchlorate	0.50 - 0.50	0 / 10	--	--	NSV	-- / --	NSV	0.25	NSV	--	--	--	No	Not detected
PETN	4.50 - 4.50	0 / 10	--	--	NSV	-- / --	NSV	2.25	NSV	--	--	--	No	Not detected
RDX	0.52 - 0.52	0 / 10	--	--	NSV	-- / --	NSV	0.26	NSV	--	--	--	No	Not detected
Tetryl	0.52 - 0.52	0 / 10	--	--	NSV	-- / --	NSV	0.26	NSV	--	--	--	No	Not detected
Inorganics (UG/L)														
Aluminum	200 - 200	8 / 10	1,960	MR02-SW05-10A	NSV	-- / --	NSV	561	NSV	870	TCEQ, 2006*	2.3	No	Mean concentration less than screening value
Antimony	10.0 - 10.0	0 / 10	--	--	NSV	-- / --	NSV	5.00	NSV	--	--	--	No	Not detected
Arsenic	10.0 - 10.0	5 / 10	3.10	MR02-SW05-10A	36.0	0 / 10	0.086	3.41	0.095	--	--	--	No	HQ less than one
Barium	200 - 200	9 / 10	24.8	MR02-SW07-10A	NSV	-- / --	NSV	24.5	NSV	25000	TCEQ, 2006	0.001	No	Supplemental HQ less than one
Beryllium	5.00 - 5.00	0 / 10	--	--	NSV	-- / --	NSV	2.50	NSV	--	--	--	No	Not detected
Cadmium	1.00 - 1.00	0 / 10	--	--	8.80	-- / --	0.11	0.50	0.057	--	--	--	No	HQ less than one, not detected
Calcium ²	5,000 - 5,000	7 / 10	35,000	MR02-SW05-10A	NSV	-- / --	NSV	13,525	NSV	--	--	--	No	Macronutrient
Chromium	10.0 - 10.0	1 / 10	0.47	MR02-SW09-10A	50.0	0 / 10	0.0094	4.55	0.091	--	--	--	No	HQ less than one
Cobalt	50.0 - 50.0	5 / 10	0.67	MR02-SW07-10A	NSV	-- / --	NSV	12.7	NSV	1500	TCEQ, 2006*	0.0004	No	Supplemental HQ less than one
Copper	25.0 - 25.0	0 / 10	--	--	3.10	-- / --	8.06	12.5	4.03	--	--	--	No	Not detected
Iron	100 - 100	8 / 10	2,140	MR02-SW09-10A	NSV	-- / --	NSV	637	NSV	1000	TCEQ, 2006*	2.14	No	Low magnitude of exceedance based on supplemental screening value
Lead	3.00 - 3.00	2 / 10	1.30	MR02-SW06-10A	8.10	0 / 10	0.16	1.44	0.18	--	--	--	No	HQ less than one
Magnesium ²	5,000 - 5,000	7 / 10	89,200	MR02-SW02-10A	NSV	-- / --	NSV	25,943	NSV	--	--	--	No	Macronutrient
Manganese	-- --	10 / 10	55.4	MR02-SW05-10A	NSV	-- / --	NSV	17.9	NSV	120	TCEQ, 2006*	0.462	No	Supplemental HQ less than one
Mercury	0.20 - 0.20	0 / 10	--	--	0.94	-- / --	0.21	0.100	0.11	--	--	--	No	HQ less than one, not detected
Nickel	40.0 - 40.0	2 / 10	1.40	MR02-SW07-10A	8.20	0 / 10	0.17	16.2	1.98	--	--	--	No	HQ less than one
Potassium ²	5,000 - 5,000	9 / 10	33,200	MR02-SW02-10A	NSV	-- / --	NSV	9,046	NSV	--	--	--	No	Macronutrient
Selenium	5.00 - 5.00	3 / 10	2.90	MR02-SW02-10A	71.0	0 / 10	0.041	2.30	0.032	--	--	--	No	HQ less than one
Silver	10.0 - 10.0	0 / 10	--	--	0.23	-- / --	43.5	5.00	21.7	--	--	--	No	Not detected
Sodium ²	-- --	10 / 10	689,000	MR02-SW02-10A	NSV	-- / --	NSV	211,797	NSV	--	--	--	No	Macronutrient
Thallium	2.00 - 2.00	0 / 10	--	--	21.3	-- / --	0.094	1.00	0.047	--	--	--	No	HQ less than one, not detected
Vanadium	50.0 - 50.0	7 / 10	3.00	MR02-SW05-10A	NSV	-- / --	NSV	8.23	NSV	20	Suter and Tsao, 1996*	0.150	No	Supplemental HQ less than one
Zinc	20.0 - 20.0	9 / 10	39.9	MR02-SW07-10A	81.0	0 / 10	0.49	9.90	0.12	--	--	--	No	HQ less than one
Dissolved Metals (UG/L)														
Aluminum, Dissolved	200 - 200	3 / 10	511	MR02-SW09-10A	NSV	-- / --	NSV	179	NSV	870	TCEQ, 2006*	0.6	No	Supplemental HQ less than one
Antimony, Dissolved	10.0 - 10.0	0 / 10	--	--	NSV	-- / --	NSV	5.00	NSV	--	--	--	No	Not detected
Arsenic, Dissolved	10.0 - 10.0	3 / 10	3.20	MR02-SW02-10A	36.0	0 / 10	0.089	4.21	0.12	--	--	--	No	HQ less than one
Barium, Dissolved	200 - 200	8 / 10	23.7	MR02-SW07-10A	NSV	-- / --	NSV	32.8	NSV	25000	TCEQ, 2006	0.001	No	Supplemental HQ less than one
Beryllium, Dissolved	5.00 - 5.00	0 / 10	--	--	NSV	-- / --	NSV	2.50	NSV	--	--	--	No	Not detected
Cadmium, Dissolved	1.00 - 1.00	0 / 10	--	--	8.80	-- / --	0.11	0.50	0.057	--	--	--	No	HQ less than one, not detected
Calcium, Dissolved ²	5,000 - 5,000	8 / 10	33,200	MR02-SW05-10A	NSV	-- / --	NSV	13,312	NSV	--	--	--	No	Macronutrient
Chromium, Dissolved	10.0 - 10.0	0 / 10	--	--	50.0	-- / --	0.20	5.00	0.10	--	--	--	No	HQ less than one, not detected
Cobalt, Dissolved	50.0 - 50.0	4 / 10	0.72	MR02-SW07-10A	NSV	-- / --	NSV	15.2	NSV	1500	TCEQ, 2006*	0.0005	No	Supplemental HQ less than one
Copper, Dissolved	25.0 - 25.0	1 / 10	3.20	MR02-SW09-10A	3.10	1 / 10	1.03	11.6	3.73	--	--	--	No	Low magnitude of exceedance
Iron, Dissolved	100 - 100	8 / 10	1,420	MR02-SW09-10A	NSV	-- / --	NSV	351	NSV	1000	TCEQ, 2006*	1.4	No	Low magnitude of exceedance based on supplemental screening value
Lead, Dissolved	3.00 - 3.00	3 / 10	5.20	MR02-SW04-10A	8.10	0 / 10	0.64	1.91	0.24	--	--	--	No	HQ less than one
Magnesium, Dissolved ²	5,000 - 5,000	7 / 10	84,700	MR02-SW02-10A	NSV	-- / --	NSV	25,058	NSV	--	--	--	No	Macronutrient
Manganese, Dissolved	-- --	10 / 10	54.4	MR02-SW07-10A	NSV	-- / --	NSV	18.0	NSV	120	TCEQ, 2006*	0.5	No	Supplemental HQ less than one
Mercury, Dissolved	0.20 - 0.20	0 / 10	--	--	0.94	-- / --	0.21	0.100	0.11	--	--	--	No	HQ less than one, not detected
Nickel, Dissolved	40.0 - 40.0	1 / 10	1.30	MR02-SW07-10A	8.20	0 / 10	0.16	18.1	2.21	--	--	--	No	HQ less than one

TABLE 4

UXO 02 Surface Water Screen

MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance ¹	Maximum Hazard Quotient	Arithmetic Mean	Mean Hazard Quotient	Supplemental Screening Value	Source	Supplemental Maximum Hazard Quotient	Retain?	Rationale
Potassium, Dissolved ²	5,000 - 5,000	9 / 10	32,100	MR02-SW02-10A	NSV	-- / --	NSV	8,789	NSV	--	--	--	No	Macronutrient
Selenium, Dissolved	5.00 - 5.00	3 / 10	1.90	MR02-SW02-10A	71.0	0 / 10	0.027	2.18	0.031	--	--	--	No	HQ less than one
Silver, Dissolved	10.0 - 10.0	0 / 10	--	--	0.23	-- / --	43.5	5.00	21.7	--	--	--	No	Not detected
Sodium, Dissolved ²	-- - --	10 / 10	670,000	MR02-SW02-10A	NSV	-- / --	NSV	208,029	NSV	--	--	--	No	Macronutrient
Thallium, Dissolved	2.00 - 2.00	0 / 10	--	--	21.3	-- / --	0.094	1.00	0.047	--	--	--	No	HQ less than one, not detected
Vanadium, Dissolved	50.0 - 50.0	5 / 10	1.00	MR02-SW05-10A	NSV	-- / --	NSV	12.8	NSV	20	Suter and Tsao, 1996*	0.05	No	Supplemental HQ less than one
Zinc, Dissolved	20.0 - 20.0	8 / 10	38.6	MR02-SW07-10A	81.0	0 / 10	0.48	13.8	0.17	--	--	--	No	HQ less than one

NOTES

* Supplemental screening value based on freshwater

1 - Count of detected samples exceeding or equaling Screening Value

2 - Macronutrient - Not considered to be a COPC

HQ - Hazard Quotient

NSV - No Screening Value

UG/L - Micrograms per liter

Generated by: Kelly Taylor

Checked by: Sara Kent

TABLE 5

UXO 02 Groundwater Screen
MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance ¹	Maximum Hazard Quotient	Arithmetic Mean	Mean Hazard Quotient	2 X Mean Background	Exceeds 2 X Mean Background?	Supplemental Screening Value	Source	Supplemental Maximum Hazard Quotient	Retain?	Rationale?
Semivolatile Organic Compounds (UG/L)																
2,4-Dinitrotoluene	0.26 - 0.26	0 / 35	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	--	--	No	Not detected
2,6-Dinitrotoluene	0.26 - 0.26	0 / 35	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	--	--	No	Not detected
Nitrobenzene	0.26 - 0.26	0 / 35	--	--	66.8	-- / --	0.0039	0.13	0.0019	--	--	--	--	--	No	HQ less than one; not detected
Explosives (UG/L)																
1,3,5-Trinitrobenzene	0.26 - 0.26	0 / 35	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	--	--	No	Not detected
1,3-Dinitrobenzene	0.26 - 0.26	0 / 35	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	--	--	No	Not detected
2,4,6-Trinitrotoluene	0.26 - 0.26	0 / 35	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	--	--	No	Not detected
2-Amino-4,6-dinitrotoluene	0.26 - 0.26	0 / 35	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	--	--	No	Not detected
2-Nitrotoluene	0.52 - 0.52	0 / 35	--	--	NSV	-- / --	NSV	0.26	NSV	--	--	--	--	--	No	Not detected
3-Nitrotoluene	0.52 - 0.52	0 / 35	--	--	NSV	-- / --	NSV	0.26	NSV	--	--	--	--	--	No	Not detected
4-Amino-2,6-dinitrotoluene	0.26 - 0.26	0 / 35	--	--	NSV	-- / --	NSV	0.13	NSV	--	--	--	--	--	No	Not detected
4-Nitrotoluene	0.52 - 0.52	0 / 35	--	--	NSV	-- / --	NSV	0.26	NSV	--	--	--	--	--	No	Not detected
HMX	0.52 - 0.52	0 / 35	--	--	NSV	-- / --	NSV	0.26	NSV	--	--	--	--	--	No	Not detected
Nitroglycerin	2.00 - 2.00	0 / 35	--	--	NSV	-- / --	NSV	1.00	NSV	--	--	--	--	--	No	Not detected
Perchlorate	0.50 - 0.50	0 / 35	--	--	NSV	-- / --	NSV	0.25	NSV	--	--	--	--	--	No	Not detected
PETN	4.50 - 4.50	0 / 35	--	--	NSV	-- / --	NSV	2.25	NSV	--	--	--	--	--	No	Not detected
RDX	0.52 - 0.52	0 / 35	--	--	NSV	-- / --	NSV	0.26	NSV	--	--	--	--	--	No	Not detected
Tetryl	0.52 - 0.52	0 / 35	--	--	NSV	-- / --	NSV	0.26	NSV	--	--	--	--	--	No	Not detected
Inorganics (UG/L)																
Aluminum	200 - 200	33 / 35	55,400	MR02-GW17-10A	NSV	-- / --	NSV	5,892	NSV	1886	Yes	870	TCEQ, 2006*	63.7	No	Within background range in filtered samples
Antimony	10.0 - 10.0	2 / 35	7.00	MR02-GW08-10A	NSV	-- / --	NSV	4.97	NSV	3.275	Yes	16	TCEQ, 2006*	0.4	No	Supplemental HQ less than one.
Arsenic	10.0 - 10.0	8 / 35	9.30	MR02-GW12-10A	36.0	0 / 35	0.26	4.98	0.14	5.77	Yes	--	--	--	No	HQ less than one. Within background range.
Barium	200 - 200	27 / 35	214	MR02-GW06-10A	NSV	-- / --	NSV	62.1	NSV	86	Yes	25000	TCEQ, 2006	0.01	No	Supplemental HQ less than one.
Beryllium	5.00 - 5.00	0 / 35	--	--	NSV	-- / --	NSV	2.50	NSV	0.31	Yes	--	--	--	No	Not detected
Cadmium	1.00 - 1.00	0 / 35	--	--	8.80	-- / --	0.11	0.50	0.057	0.36	Yes	--	--	--	No	HQ less than one; not detected
Calcium ²	5,000 - 5,000	13 / 35	63,300	MR02-IR69-GW15-10A	NSV	-- / --	NSV	7,068	NSV	69078	No	--	--	--	No	Consistent with background; macronutrient
Chromium	10.0 - 10.0	12 / 35	56.8	MR02-GW17-10A	50.0	1 / 35	1.14	9.14	0.18	3.13	Yes	--	--	--	No	Consistent with background in filtered samples. Mean HQ less than one
Cobalt	50.0 - 50.0	12 / 35	10.0	MR02-GW12-10A	NSV	-- / --	NSV	17.2	NSV	3,3984	Yes	1500	TCEQ, 2006*	0.01	No	Supplemental HQ less than one.
Copper	25.0 - 25.0	4 / 35	48.4	MR02-GW06-10A	3.10	4 / 35	15.6	14.2	4.57	2.76	Yes	--	--	--	No	Not detected in filtered samples
Iron	100 - 100	34 / 35	30,800	MR02-IR69-GW15-10A	NSV	-- / --	NSV	4,203	NSV	5999	Yes	1000	TCEQ, 2006*	30.8	No	Within background range in filtered samples
Lead	3.00 - 3.00	21 / 35	24.1	MR02-GW06-10A	8.10	4 / 35	2.98	4.14	0.51	2.80	Yes	--	--	--	No	HQ less than one based on filtered samples. Mean HQ less than one.
Magnesium ²	5,000 - 5,000	2 / 35	8,410	MR02-GW09-10A	NSV	-- / --	NSV	2,816	NSV	6363	Yes	--	--	--	No	Macronutrient
Manganese	15.0 - 15.0	31 / 35	802	MR02-IR69-GW15-10A	NSV	-- / --	NSV	76.8	NSV	214	Yes	120	TCEQ, 2006*	6.7	No	Filtered samples are generally within background range
Mercury	0.20 - 0.20	2 / 35	0.080	MR02-GW06-10A	0.94	0 / 35	0.085	0.098	0.10	0.10	No	--	--	--	No	HQ less than one. Consistent with background
Nickel	40.0 - 40.0	27 / 35	24.5	MR02-GW25-10A	8.20	8 / 35	2.99	9.90	1.21	7.97	Yes	--	--	--	No	Low magnitude of exceedance
Potassium ²	5,000 - 5,000	32 / 35	9,040	MR02-GW08-10A	NSV	-- / --	NSV	1,501	NSV	3277	Yes	--	--	--	No	Macronutrient
Selenium	5.00 - 5.00	7 / 35	1.30	MR02-GW08-10A	71.0	0 / 35	0.018	2.17	0.031	3.14	No	--	--	--	No	HQ less than one. Consistent with background
Silver	10.0 - 10.0	0 / 35	--	--	0.23	-- / --	43.5	5.00	21.7	0.8	Yes	--	--	--	No	Not detected
Sodium ²	5,000 - 5,000	31 / 35	75,000	MR02-GW09-10A	NSV	-- / --	NSV	15,704	NSV	22508	Yes	--	--	--	No	Macronutrient
Thallium	2.00 - 2.00	9 / 35	0.41	MR02-GW06-10A	21.3	0 / 35	0.019	0.78	0.037	3.78	No	--	--	--	No	HQ less than one. Consistent with background
Vanadium	50.0 - 50.0	28 / 35	54.5	MR02-GW17-10A	NSV	-- / --	NSV	12.1	NSV	4.72	Yes	20	Suter and Tsao, 1996*	2.7	No	HQ less than one based on filtered data
Zinc	20.0 - 20.0	15 / 35	424	MR02-GW16-10A	81.0	9 / 35	5.23	68.7	0.85	42.05	Yes	--	--	--	No	Filtered samples are generally within background range
Dissolved Metals (UG/L)																
Aluminum, Dissolved	-- - --	20 / 20	1,960	MR02-GW10-10A	NSV	-- / --	NSV	503	NSV	1886	Yes	--	--	--	No	Within background range
Antimony, Dissolved	10.0 - 10.0	1 / 20	1.90	MR02-GW29-10A	NSV	-- / --	NSV	4.85	NSV	3,275	No	16	TCEQ, 2006*	0.1	No	Supplemental HQ less than one. Consistent with background
Arsenic, Dissolved	10.0 - 10.0	1 / 20	4.00	MR02-GW12-10A	36.0	0 / 20	0.11	4.95	0.14	5.77	No	--	--	--	No	HQ less than one. Consistent with background
Barium, Dissolved	200 - 200	11 / 20	83.9	MR02-GW12-10A	NSV	-- / --	NSV	65.9	NSV	86	No	25000	TCEQ, 2006	0.003	No	Supplemental HQ less than one. Consistent with background
Beryllium, Dissolved	5.00 - 5.00	0 / 20	--	--	NSV	-- / --	NSV	2.50	NSV	0.31	Yes	--	--	--	No	Not detected
Cadmium, Dissolved	1.00 - 1.00	0 / 20	--	--	8.80	-- / --	0.11	0.50	0.057	0.36	Yes	--	--	--	No	HQ less than one, not detected
Calcium, Dissolved ²	5,000 - 5,000	4 / 20	60,400	MR02-IR69-GW15-10A	NSV	-- / --	NSV	6,504	NSV	69078	No	--	--	--	No	Consistent with background; macronutrient
Chromium, Dissolved	10.0 - 10.0	5 / 20	1.40	MR02-IR69-GW15-10A	50.0	0 / 20	0.028	3.95	0.079	3.13	No	--	--	--	No	HQ less than one. Consistent with background
Cobalt, Dissolved	50.0 - 50.0	7 / 20	8.60	MR02-GW12-10A	NSV	-- / --	NSV	17.0	NSV	3,3984	Yes	1500	TCEQ, 2006*	0.01	No	Supplemental HQ less than one.
Copper, Dissolved	25.0 - 25.0	0 / 20	--	--	3.10	-- / --	8.06	12.5	4.03	2.76	Yes	--	--	--	No	Not detected
Iron, Dissolved	100 - 100	16 / 20	27,800	MR02-IR69-GW15-10A	NSV	-- / --	NSV	2,849	NSV	5999	Yes	--	--	--	No	Within background range
Lead, Dissolved	3.00 - 3.00	6 / 20	3.40	MR02-GW22-10A	8.10	0 / 20	0.42	1.47	0.18	2.80	Yes	--	--	--	No	HQ less than one. Within background range.
Magnesium, Dissolved ²	5,000 - 5,000	1 / 20	7,190	MR02-GW12-10A	NSV	-- / --	NSV	2,735	NSV	6363	Yes	--	--	--	No	Macronutrient
Manganese, Dissolved	15.0 - 15.0	16 / 20	763	MR02-IR69-GW15-10A	NSV	-- / --	NSV	83.4	NSV	214	Yes	120	TCEQ, 2006*	6.4	No	Only 1 of 20 sample concentrations > maximum background. Mean concentration < screening value.

TABLE 5

UXO 02 Groundwater Screen

MCB Camp Lejeune, North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance ¹	Maximum Hazard Quotient	Arithmetic Mean	Mean Hazard Quotient	2 X Mean Background	Exceeds 2 X Mean Background?	Supplemental Screening Value	Source	Supplemental Maximum Hazard Quotient	Retain?	Rationale?
Mercury, Dissolved	0.20 - 0.20	0 / 20	--	--	0.94	-- / --	0.21	0.10	0.11	0.10	Yes	--	--	--	No	HQ less than one, not detected
Nickel, Dissolved	40.0 - 40.0	13 / 20	26.8	MR02-GW25-10A	8.20	3 / 20	3.27	11.8	1.44	7.97	Yes	--	--	--	No	Only 2 of 20 sample concentrations > maximum background
Potassium, Dissolved ²	5,000 - 5,000	17 / 20	7,390	MR02-GW08-10A	NSV	-- / --	NSV	1,484	NSV	3277	Yes	--	--	--	No	Macronutrient
Selenium, Dissolved	5.00 - 5.00	8 / 20	5.00	MR02-GW26-10A	71.0	0 / 20	0.070	2.02	0.028	3.14	Yes	--	--	--	No	HQ less than one
Silver, Dissolved	10.0 - 10.0	0 / 20	--	--	0.23	-- / --	43.5	5.00	21.7	0.8	Yes	--	--	--	No	Not detected
Sodium, Dissolved ²	5,000 - 5,000	18 / 20	39,400	MR02-GW12-10A	NSV	-- / --	NSV	13,294	NSV	22508	Yes	--	--	--	No	Macronutrient
Thallium, Dissolved	2.00 - 2.00	1 / 20	0.060	MR02-GW12-10A	21.3	0 / 20	0.0028	0.95	0.045	3.78	No	--	--	--	No	HQ less than one. Consistent with background
Vanadium, Dissolved	50.0 - 50.0	7 / 20	6.40	MR02-GW12-10A	NSV	-- / --	NSV	17.2	NSV	4.72	Yes	20	Suter and Tsao, 1996*	0.3	No	Supplemental HQ less than one. Within background range.
Zinc, Dissolved	20.0 - 20.0	12 / 20	332	MR02-GW25-10A	81.0	5 / 20	4.10	55.3	0.68	42.05	Yes	--	--	--	No	Mean HQ less than one. Only 2 of 20 sample concentrations > maximum background

NOTES

1 - Count of detected samples exceeding or equaling Screening Value

2 - Macronutrient - Not considered to be a COPC

HQ - Hazard Quotient

NSV - No Screening Value

UG/L - Micrograms per liter

Generated by: Kelly Taylor

Checked by: Sara Kent